

CARPENTER'S
GEOGRAPHY.

1625.







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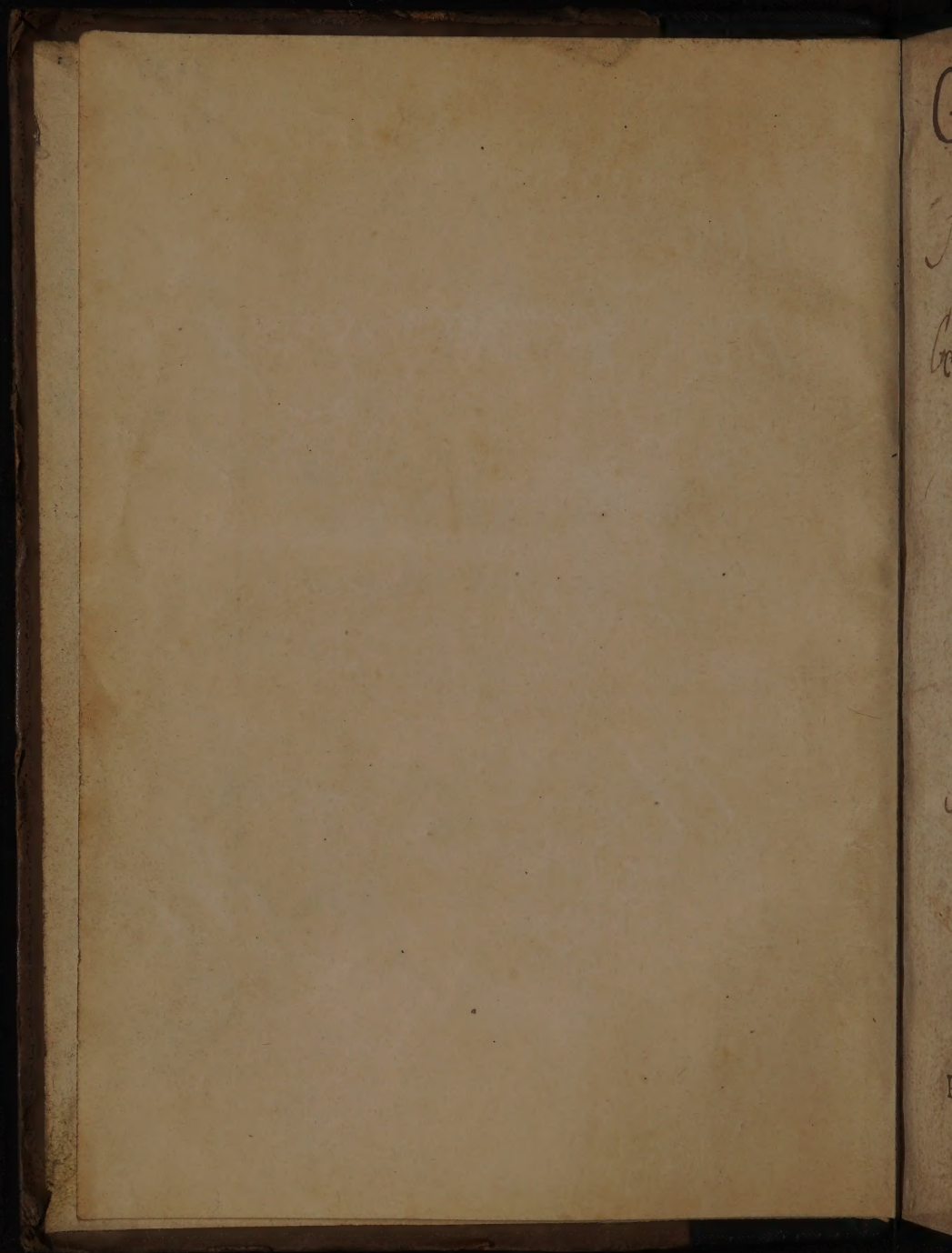
G. R. Carline, F.R.G.S.

April 1926

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GEOGRAPHY
DELINEATED
FORTH IN TWO
BOOKES.

Sampson Eytan Renald Tetlap
CONTAINING THE SPHERICALL
AND TOPICALL PARTS
THEREOF.

By NATHANAEL CARPENTER
Fellow of Exceter Colledge
in Oxford.

ECCLESIAST. I.
One generation commeth, and another goeth, but the
Earth remaineth for ever.



OXFORD,
Printed by IOHN LICHFIELD and WILLIAM
TURNER, Printers to the famous Univerfity,
for HENRY CRIPPS. An.Dom. 1625.

John Foster

his Book

1774

The Gift of the
Rev. Mr. Bingham



OXFORD,
Printed by John Richardson and William
Tanner, Printers to the University,
in the City of Oxford.



TO THE RIGHT
HONOURABLE

WILLIAM,
EARLE OF PEMBROKE,
LORD CHAMBERLAINE

*to the Kings most excellent Maiesty,
Knight of the most Noble
Order of the Garter, and
Chauncellour of the Uni-
versity of Oxford.*

Right Honourable,



His poore Infant of mine,
which I now offer to *Your*
Honourable acceptance, was
consecrated *Tours* in the
first conception: If the ha-
sty desire I had to present it,
makes

THE EPISTLE

makes it (as an abortiue brat) seeme vnworthy my first wishes, and Your fauourable Patronage; impute it (I beseech You) not to *Selfe will*, but *Duty*; which would rather shew her self too *afficiours*, then *negligent*. What I now dedicate, rather to Your *Honour*, then mine owne *Ambition*, I desire no farther to be accompted *Mine*, then *Your* generous approbation: wishing it no other fate, then either to *dye* with Your Dislike, or *liue* with Your Name and Memory. The generall Acclamation of the Learned of this Age, acknowledging with all thankfull Duty, aswell Your Loue to *Learning*, as Zeale to *Religion*, hath long since stamp't me *Yours*. This arrogant Desire of mine, grounded more on *Your* Heroick vertues, then my priuat ends, promised me more in *Your* Honourable Estimation, then some others in Your Greatnesse. The expression of my selfe in these faculties beside my profession, indebted more to Loue, then Ability, setts my Ambition a pitch higher then my Nature. But such is the Magnificent splendour of *Your* Countenance, which may easily lend *Your* poore Servant somuch light

as

DEDICATORY.

as to lead him out of Darknesse ; and, as the
Sunne reflecting on the baser Earth , at once
both view and guild his Imperfections. My
language and formality I owe not to the
Court, but *Vniversity* ; whereof I cannot but
expect *Your Honour* to be an impartiall Vm-
pier, being a most vigorous *Member* of the
one, and the *Head* of the other Corporation.
If these fruites of my Labours purchase so
much as *Your Honours* least Approbation, I
shall hold my wishes euen accomplished in
their ends, and desire onely to be thought so
worthy in *Your Honourable* esteeme, as to
live and dye

Your Honours poore Seruant

to command

NATHANAEL CARPENTER.

1. The first of these is the
2. second is the
3. third is the
4. fourth is the
5. fifth is the
6. sixth is the
7. seventh is the
8. eighth is the
9. ninth is the
10. tenth is the

11. The eleventh is the
12. twelfth is the

13. The thirteenth is the

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2
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the
9

OF THE SPECIALL CON-
TENTS OF EACH CHAP-
TER OF THE FIRST
BOOKE ACCORDING
TO THE SEVERALL
THEOREMES.

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-

Edward Foster Mrs

Book 1776

God giving grace all the
day of ^{his} Ly and all the
family of John Foster
and Ellen Foster

god bles us all

1776

William Foster

Edward



GEOGRAPHIE:

THE FIRST BOOKE.

CHAP. I.

*Of the Terrestriall Globe, the
matter and forme.*

GE O G R A P H I E is a science which teacheth the description of the whole Earth.

The Nature of *Geographie* is well expressed in the name: For *Geographie* resolved according to the Greeke Etymologie, signifieth as much as a description of the Earth; so that it differs from *Cosmographie*, as a part from the whole. Forasmuch as *Cosmographie* according to the name, is a description of the whole world, comprehending vnder it as well *Geographie*, as *Astronomie*. Howbeit, I confesse, that amongst the ancient Writers, *Cosmographie* hath bin taken for one and the selfe-same science with *Geographie*; as may appeare by sundry treatises meerey Geographicall, yet intituled by the name of *Cosmographie*. This Science (according to our appro-
ued *Ptolomie*) is distinguished from *Chorographie* foure wayes. *Ptolom. geogr. l. i. sec. 2.*

First, because *Geography* describeth the whole Spheare of the Earth, according to its iust quantity, proportion, figure, and disposition, which the principall parts of it haue; as well in respect of one another, as of the whole Terrestrial Globe: so that it only vndertakes the chief and most noted parts, such as are fines, creekes, nations, cities, promontories, riuers, and famous mountaines. But the *Chorographer* separatly handleth the lesser parts, and matters of smaller moment, such as are hillocks, brookes, lakes, townes, villages, and Parishes, without any respect at all to the places adioyning, as conferring them with the *Sphericall* fabrick of the whole Earth: Which by the same Author is well illustrated by an example, drawne from the Painters Art: For we see that a Painter, desirous to draw out and represent the head of any liuing creature, will first draw out the lineaments of the first and greatest parts; as the eyes, eares, nose, mouth, forehead, and such like; only caring that they may challenge a due & iust proportion and symmetric one with the other, not regarding the lesser particles and ornaments in each of these, wanting perhaps space competent to accomplish it. But if the same Painter would strue to expresse only an eye, or an eare, he might take space enough to designe out euery smaller lineament, colour, shadow, or marke, as if it were naturall: for in this he cares not to make it correspondent to the whole head, & other parts of the body: So happens it to the *Geographer*, who willing to delineate out any part of the Earth, (as for example, our Realme of *England*) he would describe it as an Iland, encompassed round with the sea, & figured in a triangular forme, only expressing the principall and greater parts of it. But the *Chorographer* vndertaking the description of some speciall and smaller part of *England*; as for example, the City of *Oxford*, descends much more particularly to matters of small quantity and note: such as are the Churches, Colledges, Halls, Streets, Springs; giuing to each of them their due accidents, colours, lineaments, and proportion, as farre forth as Art can imitate Nature. Neither in this kind of description needs there any consideration of the places adioyning, or the general draught of the whole Iland. The second difference between *Geographie* and

Cho-

Chorographie assigned by *Ptolomie*, consists in this; that *Chorographie* is commonly conversant in the accidentall *qualities* of each place, particularly noting vnto vs, which places are barren, fruitfull, sandy, stony, moist, dry, hot, cold, plain, or mountainous, and such like proprieties. But *Geography* lesse regarding their qualities, inquires rather of the *Quantities, measures, distances*, which places haue aswell in regard one of the other, as of the whole Globe of the Earth: assigning to each region its true longitude, latitude, clime, parallell, and Meridian. 3^{ly}, *Geographie* and *Chorographie* are said to differ, because *Geographie* stands in little need of the Art of Painting, for as much as it is conversant the most part about the Geometricall lineaments of the Terrestriall Globe, clayming great affinity with the Art called of the *Greekes*, *Ichnographie*; whose office is to expresse the figure & proportion of bodies, set forth in a plain *superficies*. But contrarywise *Chorographie* requires, as a help necessary, the Art of Painting; forasmuch as no man can fully and perfectly expresse to the eye the true portraict of cities, towns, castles, promontories, & such other things, in their true colours, liuely-hood, & proportion; except they be skilled in the Art of Painting. So that this part is by some likened to that Art which the *Greekes* call *Sciographie*, or *Scenographie*. Fourthly, & lastly, *Geographie* is distinguished from *Chorographie*, in that the former considering chiefly the quantity, measure, figure, site, & proportion of places, as well in respect *one of the other*, as of the *Heauens*, requires necessary helps of the Sciences Mathematicall, chiefly of *Arithmeticke*, *Geometry*, & *Astronomie*, without which a *Geographer* would shew himself euery-where lame & impotent, being not able to wade thorough the least part of his profession: whereas a man altogether vnpractised in those faculties, might obtaine a competent knowledge in *Chorography*. As we find by experience, some altogether ignorant in the Mathematicks; who can, to some content of their hearers, *Topographically*, and *Historically* discourse of Countries, as they haue read of in books, or obserued in their trauaile. Notwithstanding all these differences assigned by *Ptolomie*, I see no great reason why *Chorographie* should not be referred to *Geographie*; as a

part to the whole; forasmuch as the objects on which he hath grounded his distinction, differ only as a generall and a speciall; which being not opposite, but subordinate (as the *Logicians* vse to speak) cannot make two distinct Sciences, but are reduced to one & the selfe-same: at least the differences thus assigned, will not be *Essentiall*, but *Accidental*. Wherefore my scope in this Treatise shall be to ioine them both together in the same, so far forth as my Art and leisure shalbe able, to descend to particulars; which being in *Chorographie* almost infinite, will not all seeme alike necessary in the description of the vniversall Globe of the Earth. The name of *Geographie* thus distinguished, we define it to be a *Science* which teacheth the *Measure* and *Description* of the whole *Earth*. It is properly tearmed a *Science*, because it proposeth to it selfe no other end but knowledge; whereas those faculties are commonly termed *Arts*, which are not contented with a bare knowledge or speculation, but are directed to some farther work or action. But here a doubt seemes to arise, whether this *Science* be to be esteemed *Physicall*, or *Mathematicall*? We answer, that in a *Science* two things are to be considered: first, the *matter* or object whereabout it is conversant; secondly, the *manner* of handling and explication: For the former, no doubt can be made, but that the object in *Geographie* is for the most part *Physicall*, consisting of the parts whereof the Spheare is composed: but for the manner of Explication, it is not *pure*, but *mixt*; as in the former part *Mathematicall*, in the second rather *Historicall*; whence the whole *Science* may be alike tearmed *Mathematicall* and *Historicall*; not in respect of the *Subiect* which we haue said to be *Physicall*, but in the manner of *Explication*. For the object of *Geographie* (as we haue intimated) is the whole Globe of the Earth: where we are to obserue, that the Earth may be considered 3 manner of wayes: First, as it is an *Element*, out of which mixt Bodies are in part compounded: In which sense it appertaines to *Naturall Philosophie*, whose office is to treat of all naturall bodies, their principles and proprieties. Secondly, as it is supposed to be the center of heauenly motions, and so it is vndertaken by *Astronomers*. Thirdly according to its Sphæricall

super-

superficies, as it is proposed to be measured or described, in which manner it is the subiect of *Geographie*, so far forth as the parts of it haue a diuerse situation, as well in regard one of another, as in respect of the Heauens. Which restriction, although agreeing well to some part of it, will hardly square with all the rest: because many things herein are handled besides the Earths naturall site or position, as hereafter shall be taught. For which cause we haue rather defined the subiect of *Geographie* to be the *Earth*, so far as it is to be measured and described, as wanting one word to expresse the whole manner of consideration.

2 *Geographie* consists of 2 parts, the Sphæricall, and Topicall: The Sphæricall part is that which teacheth the naturall constitution of the Terrestriall Spheare.

The common and receiued diuision of this *Science* amongst *Geographers*, is into the *Generall* or vniuersall part; and the *Speciall*. Which diuision, I dare not vtterly reject, being strengthened with the authority of ancient & approued Authors. Yet seems it more aptly to be applyed to the *Historicall* part, then to the whole *Science*, as we shall after make apparant. In the mean time the diuision of it into Sphæricall & Topicall parts, seemes to be preferred in reason: Forasmuch as the *Terrestriall Globe*, which we suppose to be the subiect of the *Science*, is proposed to vs vnder a twofold consideration; first in regard of the *Mathematicall* lineaments and circles, whereof the Spheare is imagined to consist; out of which we collect the figure, quantity, site, and due proportion of the Earth, and its parts: Secondly, of the places *Historically* noted and designed out vnto vs, by certain names, marks, and characters. The former receiueth greatest light from *Astronomie*, whence some haue called it the *Astronomicall* part: The later from *Philosophie* and *Historicall* obseruation, being (as we haue said) a mixt *Science*, taking part of diuers faculties.

A 5

3. The



3 The Terrestriall Spheare is a globous or round Body, comprehended within the *superficies* of the Earth and Water.

Some haue nicely distinguished betwixt a *Spheare* and an *Orbe*; that a *Spheare* is a round massie body, contained in one surface, which is conuexe or outward as a Bowle. The other *concaue*, or hollow, in manner of an Egg-shell emptied. But this distinction seemes too curious, as fauouring too much of Scholasticall subtilty, because the name of *Orbe* and *Spheare* are many times promiscuously vsed, without difference, amōgst good Writers. This *Spheare* which we make the subject of our Science, we call *Terrestriall*, not because it consists meere-ly of Earth; (the contrary of which we shall hereafter shew;) but because the Earth is the chiefe-*st* in the composition; whence by a tropicall kind of speech, the whole *Globe* may be called *Terrestriall*.

4 The handling of the Terrestriall Spheare is either *Primary*, or *Secondary*. The *Primary* consists in such affections as primarily agree to the Earth.

The *Geographicall Affections* may be considered two wayes; either *simply* and absolutely in themselues; or *comparatiuely* as they are conferred & compared the one with the other. As for example, the circles of the *Spheare*, such as are the *Parallels* and *Meridians*, may be considered either absolutely in themselues; or comparatiuely as they con-*curre* to the *longitude*, *latitude*, *distance*, or such like accidents, which arise out of the comparison of one Circle with another.

5 The Terrestriall Spheare primarily considered, is either *Naturall*, or *Artificiall*. The *Naturall* is the true *Globe* in it selfe, without image or representation.

6 Herein

6 Herein againe are to bee considered two things ; First, the *Principles* and constitution of the Spheare; Secondly, the *Accidents* and proprieties : The principles whereof the Spheare is composed are two; viz: *Matter* and *Forme*.

7 The Matter is the substance whereof the Spheare is made, viz: *Earth*, and *Water*.

My meaning is not in this Treatise to handle the nature and proprieties of these two Elements, *Water*, & *Earth*, farther then may seeme necessary for the Geographicall constitution of the *Terrestriall Spheare*, leauing the rest to the Naturall Philosopher ; because it is supposed that few men vndertake the study of this Science, without some insight in the other. And to speak truth, this begins where the Naturall Philosopher ends. Yet because some light in each learning is necessarily required, and all men are not willing to seek farther into the grounds of *Naturall Philosophie*; it will not seeme altogether impertinent, to lay the foundation farther off, that the building thereon erected may stand surer and stronger. Wherefore taking some beginning from the matter of the Earthly Globe, we haue distinguished it into *Earth*, and *Water*, as those parts whereof the whole Globe is not essentially compounded, as one intire body in it selfe ; but rather coacervated and compacted together, each part retaining its own nature and proprieties, without any proper mixture. To expresse more fully the constitution of this Spheare, we are here to distinguish betwixt the *first* and *second matter*. The first matter was that vniuersall *chaos*, or masse, out of which, all bodies both Celestiall and Elementarie were made, & formed, as we read in the first of *Genesis*. Which whether it be the same with *Aristotle's Materia prima*, as some haue imagined, I leaue to others to dispute. The second matter of the Globe is either *Proper* or *Accidentall*. The proper we call that
whereof

whereof the Globe of the Earth most properly consists, such as are the two Elements of *Earth & Water*. The Accidentall matter is vnderstood of all other bodies, contained in the *superficies* of the said Spheare, as *Stones, Mettals, Minerals*, and such like materials, made of a Terrestriall substance, & engendred in the wombe of the Earth. Concerning the *Earth and Water*, which we make the most proper and essentiall parts of the Spheare, we will set down these two Theoremes.

I *In the Terrestriall Spheare is more Earth then Water.*

The Theoreme may be proued by sundry reasons drawne from *Nature and Experience*. Whereof the first may be taken from the depth of the waters, compared with the whole thicknes of the Earth. For the ordinary depth of the Sea is seldome found to be about 2 or 3 miles, and in few places 10 furlongs, which make a mile and a quarter. And albeit some late Writers haue imagined the obtruation to be vnderstood only of *straight and narrow Seas*, and not of the main Ocean: yet granting it to amount to 10, 20, or 30 miles, it cannot reach to so great a quantity, as to come neare the greatnes of the Earth. For the whole circle of the Terrestriall Spheare being 21600 English miles, (allowing 60 English miles to a degree of a greater circle) we shall find the Diameter to be about 7200 miles: Whose semi-diameter, measuring the distance between the center & the *superficies* of the Earth, will be 3600 miles. And if any man suppose some of the quantity to be abated, because of the Sphæricall swelling of the Water about the Earth, whose Circle must be greater then that of the Earth: We answer; first that this may challenge some abatement, but not come neare any æquality of the *Water* with the *Earth*. Secondly it is to be imagined that the surface of the Sea, howsoever as it is painted in Globes and Charts, it seeme for a great part empty and vnfurnished of Ilands; yet this for the greatest part, seemes rather to be ascribed to mans ignorance, & want of true discouery, because many quilletts and parcels of land lye yet vnknown to our Christian World, and therefore omitted, and not figured in

our

our ordinary Mappes. So we find a great quantity of Earth which lay hid and vnknown without discouery, in the dayes of *Ptolomy*, which caused him to contract and curtaile the Earth in his *Geographicall* descriptions. Which defect hath bin since that time supplied by the industrious trauailes and Navigations of later times: such as were of *Portugals*, *English*, and *Hollanders*; especially of *Columbus* the *Italian*, who (as one wittily alluding to his name) like *Noah's* Doue plucking an oliue branch from this Land, gaue testimony of a portion of Land as yet vnknown, and left naked vnto discouery. And no question can be made, but a great quantity of land, not yet detected by our *European* Navigators, awaites the industry of this age. To which alludes the Poët in these Verses:

*Seneca in
Medea. Act.*

*Venient annis secula seris,
Quibus Oceanus vincula rerum
Laxet, & ingens pateat tellus,
Typhisq; novos detegat orbes,
Nec sit terris ultima Thule.*

In after yeares shall Ages come,
When th' Ocean shall vnloose the bands
Of things, and shew vast ample lands;
New Worlds by Sea-men shall be found,
Nor *Thule* be the vtmost bound.

Another reason to proue the Earth to be greater in quantity, may be drawn from the mixture of *Earth* and *Water*: for if these two Elements should meet in the same quantity, & challenge an equality; questionlesse the whole Earth would proue ouer moist, stymie, and vnapt for habitation. Which any man may easily obserue by his own experience. For let a portion of *Earth*, & another of *Water* be mixt together in the same quantity, the whole masse will seem no other then a heap of mire or slime, without any solid or consistig substance. Moreouer the *Water* being no other then a thin and fluid body, hardly containing it self within its own bounds or limits (as *Aristotle* tea-

*De gen. &
cer.*

cheth vs) must needs require a hard and solid body, whereon to support it selfe, which body must of necessity be greater in quantity.

2 *The Earth and Water together make one Spheare.*

It may be probably collected from sundry places of holy *Scripture*, that in the first Creation, the surface of the Earth; being round and vniforme, was ouerwhelmed and compass'd round with Waters, as yet vnfurnished of liuing Creatures. Secondly, it appeares that *Almighty GOD* afterwards made a separation betwixt the *Waters* and *Dry Land*. This separation (as farre as reason may be admitted as Iudge) seemes to be effected one of these two wayes: Either by giuing super-natural bounds and limits vnto the Waters, not suffering them to invade the *Dry land*: or els by altering the *superficies* of the Earth, casting it into inequall parts, so that some-where, some parts of it being taken away, empty channels or concavities might be left to receiue the Waters; other-where by heaping vp the parts so taken away, whence were caused *Mountaines* and eminent places on the Earth. The former of these wayes seemes altogether improbable; forasmuch as it is very vnlikely to imagine, that God in the first institution of Nature, should impose a perpetuall violence vpon Nature, as hereafter in place more convenient shalbe demonstrated. Wherefore taking the later as more consonant to reason; we shall find that the Water & the Earth separated and diuided, make not two separate and distinct Globes, but one and the same Spheare; forasmuch as the concavities and hollow gapings of the Earth, are euery-where choaked and filled vp with Water, whose *superficies* is Sphæricall; & therefore helps, together with the Earth, to accomplish and perfect this *Terrestriall Spheare*. To confirme which opinion, these reasons out of common experience may be alleadged: The first is drawne from the parts of Earth and Water; For we may euery-where obserue, that a portion of Earth, and another of Water being let fall, will descend in the same right line toward the same center: whence we may evidently conclude, that the Earth

Earth & Water haue one and the self-same center of their motion, and by a consequence conspire to the composition of one and the self-same *Spheare*. Secondly, to a like Arch or space in the Heauens, is found answerable alike Arch in the *Terrestriall Globe*, whether it be measured by the Earth or Water: which could not happen, were they not accounted parts of the same *Spheare*. The third reason may be drawn from the *Eclipse* of the Moon, wherein the part of the Moon shadowed & obscured, is obserued to be one Sphæricall or round figure. This shadow, by the consent of all *Astronomers*, is caused by the *Terrestriall Spheare*, interposed betwixt the Sun and the Moon, intercepting the Sun-beames, which should illuminate the Moon; & the shadowes imitate the opacous bodies, whence they arise: But in the *Eclipse* we find only the shadow of one body or *Spheare*, and therefore according to the ground of the *Opticks*, we may conclude the body wherof such a shadow proceedeth, to be but one and the self-same *Spheare*.

8 The *Forme* of the *Terrestriall Spheare*, is the naturall Harmony or order, arising from the parts working together.

We ought here to remember what we said before; that the Earth and the Water concurre together to make one *Terrestriall Spheare*: wherefore the whole being accounted one coacervated and collected *Body*, made of two other; we are not to expect an *Internall*, *Essentiall*, and *Specificall* *Forme*, such as *Aristotle* recounts amongst the principles of a Naturall Body: but only such a one as in it self is *Externall* and *Accidental*; yet concurring (as it were) *Essentially* to the constitution of the *Terrestriall Spheare*, whose *Fabrick* and first composition, can not well be vnderstood without it. Some haue imagined the whole Globe of the Earth to be informed with one *Internall* and *Essentiall* *Forme*; which opinion seemes to haue much affinity with that of *Plato's*, concerning the *Soule* of the World: Not that *Plato* and his followers were so absurd to defend, that the World with all his parts was animated with a true vitall Soul, in the nature of a liuing Creature: but that all the members of

it were vnited together, quickned, and disposed by a certain *Energeticall* power or vertue, which had great resemblance and representation of the Soule of man. Which assertion seemes to be restored and embraced by our late *Magneticall Philosophers*, whose opinion we shall discourse and examine hereafter in place convenient. In the meantime, grounding our discourse on known principles; we can admit no other *Forme* in the *Spheare* of the Earth, then the mutuall *Harmony*, order, & consent of the parts, concurring together, and working the perfection and perpetuation of the whole. A fit resemblance whereof we may obserue in an artificiall Clock, Mill, or such like great Engine, wherein euery part duly performing its own office, there will arise and result a naturall Harmony, which not vnaptly may be termed the *Forme* of the whole Engine. Why the World should not consist of an Internall and Essentiall *Forme*, sundry reasons haue bin alleadged by our common *Philosophers*: First, because Nature neuer attempteth any thing in vain, or without a determinate end; But the particular *Formes* of speciall Bodies (say these *Philosophers*) are sufficient for the vnyty and conformation of this *Terrestriall Globe*: so that to grant an vniuersall *Forme* of the whole, were to multiply causes without any necessity, and make Nature the Mother of superfluity, which to all *Philosophers* seemes most absurd. Secondly, if this were admitted; the whole *Spheare* of the Earth would be as one continuat Body, whose parts should (as it were) suffer a fellow-feeling one of the other. Thirdly, it were a difficult matter to assigne, to what kind such a *Forme* might be reduced, whether *Animate*, or *Inanimate*. If *Inanimate*, whether it were *simple*, or *compound*. If *Animate*, whether *Vegetatiue*, *Sensitiue*, or *Rationall*; vnder the which are couched many great difficulties, as yet vndisclosed. Whether these reasons be of any great force to ouerthrow the aduerser opinion, I leaue it to further inquiry: intending here a *Geographicall*, not a *Physicall* Discourse.

C H A P. II.

*Of the conformitie of parts in the constitution
of the Terrestriall Spheare.*

- 1 **I**N the former wee haue treated of the *Naturall constitution* of the Terrestrial Spheare, aswell in *Matter* as *Forme*: It is needfull in the next place to treat of such *Affections* and *proprieties* as necessarily arise out of such a Constitution.
- 2 Those *Affections* or *Proprieties* are of two sorts, *Reall* or *Imaginarie*: *Reall* I call such as agree to the Terrestriall Globe by Nature: *Imaginary*, such as agree to it by vertue of our vnderstanding.
- 3 Againe the *Affections Really* or *Naturally* agreeing to the Terrene Spheare, are assigned either in respect of the *Earth* it selfe, or in respect of the *Heauens*.
- 4 These *Affections* are said to agree to the *Earth* in respect of it selfe, which may bee expresse and vnderstood without any comparing of it with the celestiall Bodies.
- 5 These againe are twofold; either *Elementarie*, or *Magneticall*. *Elementarie* I terme

such as haue commonly beene knowne or obserued by ordinary Philosophers. Here is chiefly to be considered the conformity of the Terrestriall parts, in the making and constitution of the whole Spheare.

In the former Chapter we haue shewed, that the Forme of the *Terrestriall Spheare*, is nothing els but the concinnity and apt conspuration of the parts whereof the whole is compounded. This conformity being diuers and manifold, as well in regard of the parts conforming themselues, as the manner; of the conformity, we shall particularly and distinctly treat of, so far as appertaines to a *Cosmographer*. Here by the way I can not but taxe some defect in most of our common *Cosmographers*, who taking the *Sphericall* roundnes of the Earth for a granted supposition, are nothing curious to search into the first grounds and causes of this rotundity, whereby it first became a globous Body; and afterwards retaines in it selfe a Naturall vigour or power (if any violence should be offered) to restore her self to her former right and perfection. All which are very pleasant & profitable, to giue an industrious Learner some satisfaction. To explaine this before we descend to particulars, we will lay this ground and Theoreme;

I *The parts of the Terrestriall Spheare, doe naturally conforme and dispose themselues, as well to the production and generation, as to the continuance and preservation of it.*

The forme of the *Terrestriall Spheare*, albeit (as we haue shewed) it be *Externall* in respect of the whole Globe: yet may we call it *naturall*; forasmuch as it issueth and ariseth from the naturall disposition and inclination of all the parts. To vnderstand which clause the better, we are to consider that a thing may be called *Naturall* two manner of wayes: first in regard of the *primary* intent of Nature; as the nearest and immediate

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end or scope to which she is directed. Secondly, in respect of her *secondary* intent or purpose, as that which must of necessity follow the former. True it is that every Terrene Body, according to Natures *first* intention, seeks and works it's owne perfection and conseruation. Neuerthelesse according to her *secondary* Intent, it concures to the perfection and good of the whole vniuerse; which we shall plainly see in a stone or clodd of earth; which separated and remoued from it's mother, the Spheare of the Earth, by his descent and falling downewards, seeks first his owne conseruation, by reuniting it selfe to the Earth whence it was taken: Secondly, of the whole Globe of the Earth, which by this vnion and addition, no doubt, is made more compleat and perfect. This conformity of the Terrestrial parts, out of which ariseth the Earths *Sphericity*; I call the naturall inclination they haue to moue & settle themselues in such a site or position, as may bring forth a *Sphericall* consistency: so that if it were possible (as what cannot be to Gods Almighty power?) that the whole Globe of the earth were dissolued and rent into little peeces; yet were that vigor and motiue inclination remaining in the parts, whereby they might settle and conforme themselues to the same *sphericall* nature, and composition which it formerly enjoyed. For all the parts thus supposed to be distracted, would (no question) meet together & conform themselues to the same point or Center; and so equally poising themselues, would restore the same Spheare so dissolued. So that we here note a double inclination and motion of earthly bodies; first by a *Right line*, of the parts tending towards the Center; the other *Sphericall* of the whole *Spheare*, whereof the first in nature precedes the composition of the Spheare, the other follows. But this latter motion I leaue doubtful, till place convenient.

- 6 The conformity of the Terrene parts is twofold; *Primarie*, or *Secondarie*. The former is that whereby all earthly bodies are by a right line carried and directed to the Cen-

ter of the Terrestrial Globe.

As in an *Artificiall* Spheare or circle, drawne by a Geometrician, their principall parts are expressed, to wit, the Center, Ray, and circumference: so in the *Naturall* Globe of the Earth, these three, as it were Naturally & Really discover themselves vnto vs. For first there is set a fixt point, to which all heavy bodies moue and conforme themselves. Secondly, there is set the line or *Radius*, in which such bodies are carried and conveyed. Thirdly, the confluence of all these parts, begets the roundnesse and Sphæricall forme. To beginne first with that which is first in nature, we will take these grounds.

I *All Earthly Bodies incline and approach to the Center as neere as they can.*

This proposition so farre forth as it concernes the two Elements of *Earth* and *Water*, is confirmed by common experience, and therefore needs no long demonstration. For we see plainly, that not only these two doe incline (as much as may be, all obstacles being remoued) to the Center of the Earth; but also all mixt bodies compounded of them, being ouerwayed with the most predominant element, to challenge to themselves the same motion. I say not that all these Terrestrial bodies driue & meet in the Center (for that were impossible, that all this massy Spheare should be contracted to one point) but that all the parts haue a mutuall inclination to approach as neere the Center, as the necessity of the place, and the concurrence of them amongst themselves will suffer. By these Terrestrial Bodies which inioye this motion & inclination, we vnderstand first the two Elements of *Earth* and *Water*, with all other bodies arising out of their mixture. To these I may adde the *Ayre*, which by reason of his affinity with the Earth and Water, and naturall conformity to the same Center, we may well tearme an earthly body. It is commonly reported that the Ayre is *light*, and therefore carried vpwards, not inclining at all to the Center of the Terrestrial Globe; as the parts of these two Elements are. But this assertion, although bolstered vp, both with antiquity and authority; I take either to bee false, or misvnderstood, and

and that I speake no more herein then I can proue; I will produce some reasons (strong enough, as I thinke) to perswade that the Ayre is a heauy body, hauing a due inclination and conformity to the Center of the Earth: First therefore will I produce this experiment. When a Well or deepe Trench is digged vp in the earth, I would willingly demand whether the Aire descends to fill vp this Trench or concauity; or else a void space is left vnfurnished of any natural body to fill it? If they admit the latter, they wil consequently bring in againe that *vacuum*, or void space which *Arist.* and all sound Philosophers haue long since proscribed the confines of nature. If they affirme the former, that the Ayre descends to fill vp this empty space, I will aske againe, whether this descent of the Ayre be violent or naturall. If they say Naturall, they admit our assertion, that the Ayre naturally descends towards the Center, and so by consequence that it is heauy and not light by nature. Neither according to our *Peripateticall* Philosophy can wee ascribe more then one motion to the Aire, because it is a ground generally receaued among *Aristoteleans*: that One simple body can claime but one simple motion: much lesse one simple forme, as that of the Aire, can produce two opposite and contrary motions, such as are Ascent & Descent of the same body. If they chance to light on the other member of our distinction, and say that the motion of the Aire in this sort is violent, it must needs follow, that it must haue some externall cause or principle whence it should proceed; because all such motions proceed from externall causes. But here no such cause can be assigned: For the cause would be either the Earth which is so made hollow, or the emptinesse, or *vacuum*, or at least the other parts of the Aire. That it is not the Earth, may be proued; first because no Philosopher hath euer shewed any such Attractive power to reside in the Earth, but rather the contrary; because the Earth and Ayre by most haue beene thought opposite in nature, and repugnant one to the other. Secondly, because Philosophy teacheth, that no agent can worke vpon a separate and distinct patient, except there be a meeting of the Agent and Patient in some meane. But here in this supposition, the Earth is imagined to drawe and attract

the Aire, which as yet it toucheth not. That this externall cause is not the *Vacuum* or Emptinesse, is plaine; because it was neuer granted to haue any being or existence, much lesse any causality in nature. Some perhaps will say, that not the *vacuum*, it selfe, but the euitation and auoiding it, is the cause of the motion. I deny not but this may in some sort bee interpreted a cause, but the doubt is not answered: For we seeke not a *Finall* but an *Efficient* cause; and a curious searcher into Nature, will hardly rest in a meere finall cause. For the finall cause, so farre forth as it is a cause preceding the effect, can no otherwise bee conceiued then in the intention of the Agent: then must enquiry be made againe what the Agent should be, and so will the probleme rest vncleered. 1. Because one parcell of the Aire could not moue another, except the same were first moued it selfe, and so a new Agent must of necessity be found out. 2 The Agent and the thing moued or Patient, ought to be two separate and distinct bodies: But the parts of the ayre meeting together, become one continuuate body. No shift is there left for these Philosophers but one distinction, wherein they distinguish betwixt the *Vniuersall* & *Speciall* forme. The Aire, as they affirme, according to his *Speciall* forme, ascends vppward from the Center of the *Earth*: yet by the *Vniuersall*, for the conseruation of the whole vniuerse, it may sometimes suffer a contrary motion, as to moue downeward toward the Center. In which distinction they suppose they haue cut the throate of all contrary reasons. But who so vnderstands himselfe, shall finde it but as a weake reed, to hurt his hand which rests on it: for a second enquiry will be made, what this vniuersal forme should be. For by it they vnderstand of necessity either an *Internall forme* or Nature; or an *Externall resiliencie* and harmony of the parts, such as we haue described in the first Chapter of this booke. If they vnderstand this latter, it cannot any way bee a cause of this motion; because it followes and ariseth out of this motion concurring with the rest, & no way precedes it: whereas on the contrary part euery cause is to goe before his effect: Secondly, this vniuersall forme or nature compared with the speciall, there would arise a *Subordination*, and not a *Coordina-*

tion,

the least ponderous. Yet we deny not but the Water and Aire being settled in this wise, are in their naturall places; which to vnderstand, we must repeat what we said before, that Nature hath a twofold *intention*; the one *primarie*, the other *secondarie*. Indeed if we consider Natures primary or speciall inclination in the bodies themselves, we shall finde them (as we said) immediately directed to the center as neare as might bee: but the secondary intent of Nature was, that the bodies should so settle and conforme themselves, as that each of them should obtaine a place according to his degree of massinesse and waight. Out of this may be answered a certaine obiection which some haue produced, to proue the Aire to be absolutely light in his owne nature. Experience teacheth vs (say these men) that a bladder blowne vp with winde, or an empty barrell being by force kept vnder water; the force and obstacle omitted, will suddenly ascend to the top; and that a man ready to sinke in the Water, will not so easily sinke downie while he can hold his breath: all which effects they ascribe to no other cause, then the inclination of the Aire to moue vpwards from the center. But indeed this motion, howbeit agreeable to the vniuersall nature and consistency of the Spheare, is notwithstanding in respect of the Aire it selfe, vnnaturall and violent; because this ascent of it is not caused by the forme of the Aire, but the interposition of a heauier body struiuing for the same place, and so reverberating it backe from the place, whereunto it tended. For here it is to be imagined, that the bladder or empty barrell drowned in the water, claimes and inioyes for the time that place or distance, which otherwise so much water should occupie; to wit, so many inches of feet from one side to the other. No maruell then that obstacles remoued, the Water being most ponderous and waighty, receiues his own right; and (as it were) shoulders out the Aire, and violently driues it off to his owne habitation. Whence many haue imagined that this motion is proper and naturall to the Aire, when of it selfe it is meerey violent, and enforced by the interiection of another body more waighty & ponderous then it selfe.

7 In this conformity of the Terrestriall parts, two things are to be obserued: 1 The center it selfe: 2 The parts which conforme themselues vnto it. The Center is an imaginary point in the midst of the Terrestriall Globe, to which all the parts are conformed.

The Fathers of the *Mathematicall* Sciences, haue laboured to deriue all their doctrine from a point, as the first and most simple principle wheron al the rest depend. Not that they imagine a point to be any positive *entity* in it selfe; but because it is the first bound of magnitude, whence all terminated quantities take their originall. The first principle we may call it, not of naturall constitution, because a thousand points collected, could not be so compounded, 'as out of it should arise the least magnitude; for (as the Philosopher hath taught vs) continue and diuisible things cannot be made out of such things as are meerely discontinuate and indivisible, but because it is the first *Mathematicall* principle or beginning of termination and figuration. This point, although it haue euery-where an vse in *Geometrie*, yet no-where more remarkeable then when it becomes the center of a circle; which center we ought not to imagine a meere *Geometrical* conceit, but such as findes ground in the *Naturall* constitution of the *Terrestriall Sphaere*. For seeing all terrene bodies are carried in a right line as by a *Radius* to one point, from euery part of the circumference; we may obserue a center as it were designed and pointed out by Nature it selfe in the Globe: Some haue heere distinguished betwixt a point *Physicall*, and a point *Mathematicall*, as allotting the former *Latitude*, and sensible existence; but making the other meerely *Indivisible*. But if the matter be rightly vnderstood, they are not two points, but all one, distinguished onely by a diuers name of conceit or consideration. For we consider first a point as it is existent in a sensible particular body, and so we cal

it *Physicall*. Secondly we abstract it from this or that body sensible; but alwayes conceiue it withall to be in some body, and in this sort we terme it *Mathematicall*: for the Mathematician abstracts not a *Quantity* or *Quantitative* signe from all subiects; for so being an accident, hee should conceiue it abstracted from its owne nature; but from this or that sensible body; as wood or stone. Such a point ought we to imagine the center of the Earth to be, not participating of any latitude or magnitude, albeit existent in some magnitude. I am not ignorant that some Writers haue taken a *Physicall* point for a small and insensible magnitude, in which sense the Globe of the Earth is called the center of all heauenly motions. But this sense is very improper; and besides in this example is to be vnderstood a point *Opticall*, as such as carries no sensible or proportionable quantity in regard of the sight. Taking then the center of the Earth to bee a point fixt in the midst of the Earthly Spheare, as we haue described, we will further describe the nature of it in two Theoremes.

I *The center of the Earth is not an Attractive, but a meere Respectiue point.*

An *Attractive* point I terme that, which hath in it a vertue or power to draw and attract the Terrestriall parts or bodies, in such sort as the Loadstone hath a power to draw iron or Steele. But a *Respectiue* point is that, which the Bodies in their motions doe respect and conformance themselves vnto, as the bound or center to which their course is directed. Which may be illustrated by the *directiue* operations of the Load-stone (which we shall hereafter handle) by which the *Magneticall Index* or needle pointeth directly Northward: not that in the North is fixed any Attractive vertue or operation, which might cause that effect; but because the Magnetical Instrument is directed towards such a point or center. That the Center of the earth hath no Attractive force, may be proued, 1 Because it cannot in any probability be thought that an Imaginary point hauing only a *privatiue* Being & subsistence, should challenge to it selfe any such operation. For all *positiue* effects, proceed

out of positive causes, neither can it be imagined that this Attraction should grow out of a mere privation. Secondly, should this be granted, that the motiō of Earthly parts should be from the Attractive vertue. of the Center; it would follow necessarily, that this motion should not be *Naturall*, but *violent*: as proceeding from an *externall* cause, which all ancient and moderne Philosophers deny.

2. *The same point is the center of Magnitude and waight in the Terrestriall Spheare.*

That the same point in the *Terrene* Globe, should make the center both of *Magnitude* and *Waight*, may seeme very plain: Because wee are not to multiply things and Entities in our conceit, without any necessary consequence drawne from Nature or Reason, enforcing vs thereunto. But what reason could euer perswade any man, that the Earth had two Centers, the one of *Waight*, the other of *Magnitude*, but only a bare Imagination, without prooffe or demonstratiō. Secondly, if this were granted, that the Center of magnitude were remoued some distance from the other; then consequently would one part of the Earth ouer-poize the other in ponderosity, & so the whole Spheare would either be shaken out of its place, or dissolue it selfe into its first principles. Both of which being by experience contradicted, our assertion will stand sure and vndoubted. In the meane space, we deny not but that some litle difference may be admitted in regard of the vnequall parts of the Earth; but this must needs be so small and insensible as cannot be calculated, or cause any alteration.

3. The *Terrene* parts conforming themselves to this center, may bee considered two wayes: either *Absolutely*, or *Comparatiuely*. *Absolutely*; as euery part is considered in it selfe.

9. A terrestriall part considered in it selfe, vndergoes.

dergoes the respect either of a *Point* or *Magnitude*; as a point, when any signe or point in it selfe is considered in regard of his conformity to the center.

A *Point*, albeit existing still in some magnitude (as we haue shewed) may notwithstanding be abstracted from this or that body, as seruing for the *center* of any body, whose naturall inclination and conformity to the vniuersall center of the Earth, we may in the first place handle, as the Rule by which the motion and inclination of the whole magnitude ought to bee squared.

I *Euery point or center of a waightie body, is moued toward the center of the Terrestriall Spheare by a right line.*

A *Right line* is the measure and rule almost of all *Naturall* actions; which albeit it be familiar in almost euery operation; yet most of all in the motion of the Earthly bodies tending to the center of the Earth. Why *Nature* in this kind should chiefly affect a *Right line*, sundry reasons may be alleaged: 1 From the *End* which *Nature* doth propose it selfe, which is to produce the worke which shee intends, the readiest and shortest way; as *Aristotle* testifies of her in the 5 of his *Metaphysikes*. Now it is manifest that a *Right line* drawne betwixt the same points, is alwayes shortest, as *Euclide* shewes in his *Elements*; where hee demonstrates that two sides of any *triangle* being counted together, are longer then the third. The better to vnderstand the working of *Nature*, we shall obserue in the motion of a heauy part to the center, a double scope or end; first, that the said part of a *terrestriall* body, should be moued or separated from the place to which it is by violence transposed. Secondly, that this body should bee restored home, and vnited to the *Sphericall* substance of the Earth, in which it must chiefly seeke its preservation. That these two ends are best and soonest compassed by a *right line* is most manifest. For first a *sepa-*

paration from the place to which it is moued, is more quick & expedient by a right line; forasmuch as crooked and circular lines, turne backe as it were into themselves againe. Also the v-nion and coniunction of a part with the *Sphere* of the *Earth*, is most indebted to a right motion, because (as we haue declared) the way is shorter. Secondly, it may be alleaged, that *Nature* is an *uniforme* and necessary Agent, restrained to one only bound or end, and therefore can neither strengthen, weaken, remit or suspend the action, but workes alwayes by the same meanes, the same effects; whence it is that shee chuseth a right line, being but one betwixt two point; whereas crooked lines may bee drawne infinite; and the motion directed by crooked lines, would prove various and opposite to the prescript of *Nature*. Moreover should we imagine that nature at any time wrought by a crooked or circular line, it might be demanded, from what Agent this obliquity should arise? not from *Nature* it selfe: because (as we said) shee worketh alwayes, to the vtmost of her strength, having no power to remit or suspend her actions. But a crooked motion ariseth from the remission or slackening of the Agents force, and turning it away from the intended end, which onely findes place in Free and *voluntary* Agents. Neither comes this Deflexion from the *medium*, or Aire, because it can haue no such power to resist. Thirdly, if the motion were not performed in a right line, it could haue no opposite or contrary; because (as *Aristotle* teacheth) *To a circular or crooked motion, no other motion can be opposite or contrary in respect of the whole circle; but onely in regard of the Diameter*, which is alwayes a right line. By this it is plaine, that a *waighy point* considered in it selfe abstractly, cannot but be earried to the center in a right line: which right line, *really* and *Physically*, points out vnto vs a *Radius* or *Beame* drawne from the center to the *circumference*, to shew that the God of *Nature* in composing the earthly globe, both obserued and taught vs the vse of *Geometric*.

• de calo
ap. 4.

2. *A point mouing toward the Center, will moue swifter in the end, then in the beginning.*

This hath bin plainly obserued by experience, that a *stone*

Ice

let fall from a towre or high place, will in motion grow swifter and swifter, till it approach the ground or place whereon it falls. The reason may be giuen from the *Aire*, which resists so much the lesse, by how much the body descendeth lower toward the *Earth* or center; because when it is higher, the distance being greater, the parts of the *Aire* will make more *Resistance*. The reason rendred by *Aristotle* of this *Resistance*; is, because in the beginning of the motion, the stone or heauy body findes the *Aire* *quiet* and *fixed*: but being once set on motion, the higher parts of the *Aire*, successiuelly moue those which are vnder, being driuen by the violence of the stone so falling, and prepare, as it were, the way for his comming. This reason may in some sort content an ingenious wit, till a better be found out.

10 So much for the motion of a heauy point or center: it remaines that we treat next of the motions and conformity of *Magnitudes* to the center of the *Earth*: wherein wee consider not onely the *Center* or middle point, but the whole masse of the magnitude, whole motion and conformity shall be expressed in this Theoreme,

1 *The motion of a magnitude toward the center, is not meereley naturall, but mixt with a violent motion:*

This may easily be demonstrated; because no point of any magnitude is moued to the Center naturally, but the *middle point* or center of the magnitude: For although the *Center* be moued in a *perpendicular* line, which makes right angles with the *Horizon*; yet the extreme parts are moued in lines *paralloll*, which cannot possibly make right angles with the *Horizon*, or meet in the *Center*; which may bee showne in this Fi-

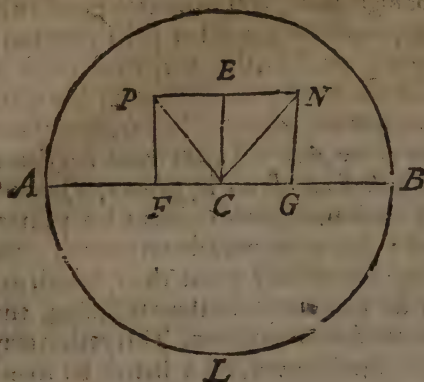


figure. Let there be a Circle as A B L. This done, wee will imagine a certaine magnitude hanging in the Aire, and tending to the Center C, which is signified by the line P E N. It is certain that the Center of the magnitude E, will moue and conforme it selfe downward toward

the center of the Earth by the line E C, which motion will be *naturall*, as that which is deriued to a center from a circumference by the direct *Radius*; which is the Rule of all naturall motions: But the other parts without the center of this magnitude, cannot moue but in so many lines, which shall be *parallel* the one to the other: as for example, the point N must needs moue in the line N G, and the point P in the line P F, which being of equall distance, will neuer concur in the Center, and therefore cannot bee esteemed naturall rayes of the circle; whence we may collect, that the motion of these parts is not *naturall*, but *violent*: for if any should imagine the motion of these parts to be naturall, then should the point N moue to the center of the Earth by the line N C, and the point P by the line P C; and so by how much the more any waighty body should approach the Center of the Earth, by so much it should be diminished and curtailed in his quantity: so that in the Center it selfe, all the parts should concur in an *Indrvisible* point, which is absurd and contradicts all reason.

Hitherto haue we spoken of the conformity of all Earthly and waighty bodies to the Terrene center, as they are taken *Absolutely*.

lutely. It now remaines that we speake of these bodies as they are taken *comparatiue-ly*, being compared one with the other.

This discourse properly belongs to an art which is called *Statick* and is *Mathematicall*; whose office is to demonstrate the affections of *Heauinesse* and *Lightnesse* of all Bodies out of their causes. The chiefe sensible Instrument whereon these properties are demonstrated and shewne, is the *Balanx* or Ballance. But these specialties wee leaue to such as haue purposely written of this subject: amongst which the most ancient and chiefe is *Archimedes*, whose heauenly wit ouertooke all such as went before him, and out-went all such as followed. Enough it will seeme in this Treatise to insert a proposition or two *Staticall*, to shew the *Conformity* of two magnitudes, and their proper Center, mouing downeward toward the Globe of the *Earth*, & it's Center.

I. *The lines wherein the centers of two heauy bodies are moued downeward, being continued, will meet in the Center of the Earth.*

A heauy point or Center (as we haue demonstrated heretofore in this Chapter) is moued toward the Center of the world in a right line, which is imagined to bee a *Ray* of the whole Spheare deriued from the circumference to the Center, & therefore it is impossible they should be parallell or *Equidistant*, but concurrent lines. But because the whole distance betwixt vs and the Center is very great; it must needs happen that in a small space the concurrence of perpendicular lines is altogether insensible. For if two perpendicular or heauy points moued in a line, should be distant one from the other the space of 10, a 100, or more feet; because this distance is very little in respect of the *semidiameter* of the *Earth*: the angle of concurrence must needs bee very little, and by consequence those two rayes or lines, measuring the descent of two heauy Bodies, will seeme altogether *Equidistant*. Yet that there is such a concurrence, *Nature* and *Reason*.

Reason will easily consent. Hence we may detect a popular error beleueed of the vulgar, that the walls of houses standing vpright are *parallel* and of equall distance; when contrariwise it is plaine that such walls are erected by a *perpendicular*, and measured by perpendicular lines, which being drawne out in length will meet in the Center of the Earth. The like may wee pronounce of a deepe *Well*, whose sides or wall are erected perpendicularly; and therefore should it reach as farre as the Center, it must needs follow that the sides growing neerer and neerer as they approach the Center, would in the end close or shut vp into a *Pyramide*, whose *Base* should bee the mouth of the Well. Likewise if a Tower should be erected to the Heauens, it would be strange to imagine, how great and broad the vpper part of it would be in respect of the bottom. Hence againe it may be inferred, that any pauement leuelled by a perpendicular is not an absolute plain, but rather the *portiō* or Arch of a *sphaerickall superficies*, whose Center is the same with the Center of the whole Earth. But this roundnesse in a small distance is no way sensible; but in a great pauement of foure or five hundred paces leuelled perpendicularly; it will make some shewe of roundnesse: whence it must needs follow, that an extraordinary great pauement measured ouer by a right line, cannot be called leuell or equally poized, forasmuch as it is not euery where equally distant from the Center of the Earthly Globe.

2 Two heavy bodies of the same figure and matter, whether Equall or Vnæquall, will in an equall time moue in an equall space.

This proposition being inuented by one *Iohannes Baptist de Benedictis*, is cited and confirmed by *Iohn Dee*, in his Mathematicall Preface to *Billingstie's Geometry*. Which corrects a common error of those men, which suppose the lighter bodies generally not to moue so fast downward to the Center as the heavy. The demonstration of this Theoreme, being drawne from many *Staticall* principles, which wee cannot here conueniently insert, we are enforced to omit; as intending not the search of these matters any farther then they direct vnto the knowledge of

of *Geographie*. Yet were it no hard matter to giue a more popular expreſſion of this reaſon out of the proportion betwixt this *weight* of the heauy Body, and the Reſiſtance of the *Medium*. Becauſe the Greater Body, as it is carried down-ward by a greater force and violence; ſo on the other ſide it meets a greater impediment, being not able ſo ſoone to diuide the Aire, as the Leſſer: Likewise the Leſſer body falling with leſſe force, yet is more apt to diuide it then the other. Whence both ſet the one againſt the other, there wilbe no diſparity in the time and motion.

12 Of the *primary* conformity of the Terreſtriall bodies in the conſtitution of the Terreſtriall Spheare, we haue treated: It now ſeemes needfull that wee deſcend to the *ſecondary*, which is the inclination of all the parts, to make a round Spheare or Globe.

I *The Terreſtriall Globe is round and Sphæricall.*

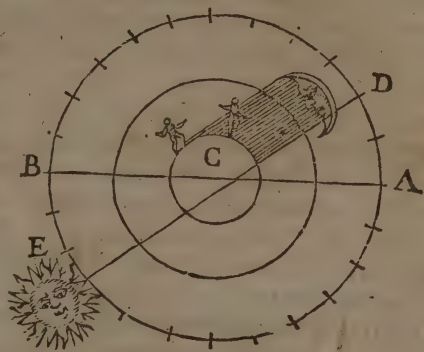
This Proposition is of great uſe, and one of the chiefeſt grounds in *Geographie*. The ground of the Sphæricall figure of the Earth, is the right motion of heauy bodies to the center. For this right motion (as we haue ſhewed) doth expreſſe one *Beame* of the circle, by whoſe circumvolution is produced the circumference of it, which we call *Secondary conformity* of the parts of the Earth; inſomuch as it growes *Mathematically* (as it were) out of the firſt. For this Sphæricall figure of the Earth, ſundry ſound reaſons are vrged by *Geographers*: Firſt, that the Earth is round according to its *Latitude*, that is, from North to South. Secondly, according to its *Longitude*, that is, from Eaſt to Weſt, and therefore muſt it needes bee abſolutely Sphæricall. The firſt part is ſhewed, that it is round from North to South; for if a man trauell from North to South, or contrariwiſe from South to North, he ſhall perceiue new ſtarres in the Heauens to appeare and ſhe w themſelues, which before he

L. de sphær.

could not see: which can be referred to no other cause then the Sphæricall convexitie, or swelling of the Earth. As for example; The starre which is called *Canopus*, which is a notable starre in the ship; appeares not at *Rhodes*, or at least from high places. But if you trauell forth Southward from *Italy* into *Egypt*, to *Alexandria*, the same starre (*Proclus* obserues) will manifest it selfe to your sight the fourth part of a signe aboue the *Horizon*. From whence wee may draw a sound prooffe, that there is a Sphæricall and gibbous convexitie, which interposeth it selfe betwixt *Rhodes* and *Egypt*. In which place, the people which inhabite that part of *Egypt*, which borders vpon *Arabia*, which are called *Troglodites*, of their dwelling in caues, cannot see any Starre of the *Great Beare*. Whence we may conclide, that the Earth from the North to the South, is round and Sphæricall. For if otherwise the Earth were *plaine*, all the Northerne starres would appeare to the inhabitants of the Southerne Regions; & on the other side, all the other Southerne constellations would be seene of the Northerne inhabitants, which sense and reason altogether contradict. *Secondly*, that the Earth is round according to its *Longitude* betwixt East and West, may be proued by two reasons. The first is taken from the rising and setting of the *Sunne*, *Moone*, and other Starres, forasmuch as all they doe not arise or set with all Nations at the same houres. For with the inhabitants of the East, the Sun-rising is sooner; with the *Western* inhabitants later; and that in such proportion, that euery 15 degrees measured out by the Sunnes diurnall motion, adds or subtracts one whole houre in the length of the day. This is found by experience and testimony of *Cosmographers*, that the Sunne riseth with the *Persian*, inhabiting toward the East, foure houres sooner then to the *Spaniard* in the West. Sundry other the like examples may be alleaged; all which we must needs impute to the Sphæricall roundnesse of the Earth, proportionally increasing betwixt East and West. The other reason to confirme this last point, is drawne from the *Eclipses* of the Sunne and Moone, which would not appeare in diuers places, at diuers houres, if the Earth were *plaine* or square. We see plainly that *Eclipses* of the Moon appeare sooner to the *Western*

Westerne people, but later to the Easterne. As (according to *Ptolomie*) in *Arbela* a townes of *Assyria* (where *Alexander* overcame *Darius* the last King of the *Persians*) was there observed an Eclipse at the fifth houre of the night, which selfe same Eclipse was seene in *Carthage* at the second: which to any man appears plainly in this figure here inserted. In like manner an Eclipse of the

Sunne at *Campania* which was observed betwixt 8 and 9, was (as *Pliny* reports) seene in *Armenia* betwixt 10 and 11 of the clocke. Whence may be gathered that this difference of appearance arose from the roundnesse of the Earth, interposing it selfe betwixt these



Lib. 2. c. 72

two places. Another reason to prove the *Sphericall* figure of the Earth, is drawne from the Eclipse of the *Moone*, wherein the obscured point is described by a *Sphericall* figure, which must needs argue, that the body which causeth the shadow, is also round. For as the *Optickes* teach vs, the shadow is wont to follow and imitate the opacous body whence it proceedes, and all men confesse that the Eclipse of the *Moone* is made by the interpositiō of the Spheare of the Earth betwixt the Sun & Moon, intercepting the beams of the *Sun*, which should illustrate & lighten the *Moone*. The third reason may be taken from the absurdities which would follow, should we admit any other figure besides. For granting it to be *plaine* (as some of the *Platonists* haue imagined) it would necessarily follow in reason;
 1 That the *Elevation* of the Pole would be the same in all the parts of the Earth. 2 That there would be the same face and appearance of the Heauens in all places. 3 That the Sunne and Moone, with other starres, would in all places arise alike at the

E 2

same

same houres. 4 That all *Ecclices* would appeare to all places at the same houres. 5 That the same *quantity* of dayes & nights would bee at all places. 6 That the *shadows* would be euery where al ke; and one Region would not bee hotter or colder then another, all which would plainly stand opposite to reason and experience. As many or more would proue the absurdities of those, that ascribe to the Earth any other figure then Sphæricall. Which I willingly passe ouer, as not willing to fight with shadows, and faigne an opposition, where I scarce finde an aduersarie. These reasons are sufficient to proue, that the whole masse of the *Earth* is *Sphæricall*. Divers other popular arguments may be drawne from the *finall* cause to countenance this Assertion. For no other figure can be assigned to the Earth, which can more vphold the order of Nature, or speake the wisdom of the Omnipotent Creator. 1 Because such a Figure would best besee me the Earth, the seate and dwelling-place of all liuing Creatures, which is most capable: because otherwise the God of Nature would seeme to doe something in vaine, & without cause: Forasmuch as the same *capacity* might be confined within stricter bounds. Now it is apparant to all *Mathematicians*, that amongst all those figures which they call *Isoperimetrell*, a *Circle* is the most capable, & amongst the rest, those which approach neereft vnto a circle. And as wee esteeme of a circle described in a plaine surface, so must we iudge in *solides* of a *Spheare*. Which profitable Geometry of Nature wee shall finde instill'd into most liuing Creatures, who by a certain Naturall *Instinct*, without the vse of Reason, make their Nests and resting-places of a *Sphæricall* Figure, as most convenient, and of greatest capacity; as experience shewes vs, in the Nests of Birds, and Bee-Hiues, wherein the cells are fashioned round & Sphæricall. 2 We shall find the Holy Scriptures consonant to this opinion in diuers places; but that it might seeme impiety to vse those sacred helpes in a matter out of controuersie, and needing no such Demonstration.

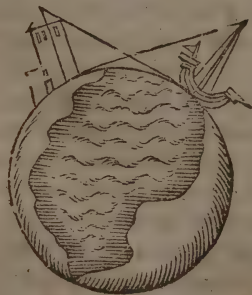
2 *The rugged and vnequall parts of the Earth, binder not the Sphæricall roundnesse of it.*

It is thought by ignorant people, that the Earth is not round, because of the rugged and vneuen parts of the *superficies* of it: For some-where it swells with great and high *mountaines*, rocks, and hills; Other-where it seemes indented, and (as it were) trenched into valleyes, & concavities; all which seeme to detraekt from a true Sphæricall *superficies*; because in such a one, euery line drawne from the Center to it, should be æquall one to the other. Indeede that the *Globe* of the Earth is not *Absolutely* and *Geometrically* round, as an *Artificiall* Spheare, is cōf. firmed by *Eratosthenes*, cited by *Strabo* in his 1 book of *Geographie*: whence *Pliny* in his 2 book, *cap 21*: saith, that the *Earth & Water* make one *Globe*, not so absolutely round as the *Heauens*, but much different, as also *Strabo* confirms. This proposition depending on these 3 reasons which follow, will shew that this *Inequality*, how great soeuer it seeme to the sight, is altogether *insensible*, and bearing no proportion with the huge vastnesse of the whole *Earth*. The first is taken from the perpendicular hight of the greatest and highest mountaine, which is seldome or neuer found to exceed 10 miles, (although few *Mathematicians* will grant so much) whereas the whole Diameter of the Earth contains no lesse then 7200 *English miles*; so that these hills compared to the thicknes of the *Earth*, are but as 10 to 7200: which indeed hath no *sensible proportion*. The second is taken from the *Eclipse* of the *Moon*, which being caused by the shadow of the interposed *Earth*, is described by a *Sphæricall figure*, without any vnæquall or rugged parts, which no doubt, would appeare, if these parts challenge any due proportion, or sensible quantity, in respect of the whole *Earth*. Thirdly, some haue illustrated this by a round *boule*, or ball, whose externall surface, although *vnæquall*, and *indented* here & there with scotches, other-where swelling with knobs, will notwithstanding being interposed betwixt the sun beame and a wall, or such p ace, giue a round or Sphæricall shadow in the same wall or plaine, in regard of the litle quantity of these small parts in respect of the whole Body. In like sort must we imagine the mountaines and vnæquall parts in the face of the *Earth*, to be no otherwise then as so many warts or pimples in

the face of a man , which cannot alter his due proportion or symmetry of the parts.

3 *The Water concurring with the Earth in the Globe is also Sphericall.*

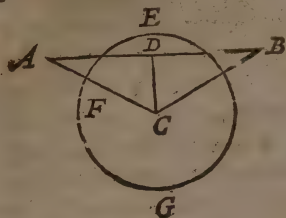
It is a proposition agreed on by *Archimedes*, and almost all the ancient *Mathematicians* of any note, that the *superficies* of the Water, or any other liquor, standing and subsisting quietly of it selfe, is *Sphericall*; whose center will be the same with the center of the whole *Earth*, which we are here to handle, because it appertaines to the making vp of the *Terrestriall Globe*; although wee shall haue occasion hereafter to speake specially concerning the *Water* in *Hydrographie*, in the second part of this Treatise. The reasons to confirme this assertion , beside those that in generall proue the *Sphericity* of the Terrene globe are diuers: 1 It is obserued that *Passengers* in a Ship, lanching out into the deepe from some Hauen , will first perceiue the *Towres*, *Buildings*, *Castles*, *Promontories*, and *Trees* standing on the land, in their perfect figure and greatnesse: sayling farther off, they will obserue them on the lower part, little & little diminished, vntill such time as the tops only of the houses and trees will be *visible*. In like sort they which tarry on the Land, will first espye the top and mast of a Ship approaching, which sight will be perfected more and more, as the Ship drawes toward the land , and at last all parts of it will shew themselves; which accident can be cast vpon no other cause, then the *Sphericall* roundnesse, and swelling



of the water ; which, if the distance be great, interposeth it selfe betweene the station on the Land and the Ship where- in *Passengers* are conveyed, which experiment is expressed in this Diagramme here annexed. Certaine *Platonicks*, of which the chiefest is *Patricius* a late *Writer*, would ascribe this

this experiment to the impediment of the sight, caused partly by the distance which cannot perfectly represent the object, partly by the interposed vapours arising in the Sea; partly by the quivering light which is spread by the refraction of the Sun-beames in the water. I deny not but these causes may somewhat hinder, and cause that the true and perfect *Species* of a body cannot alwaies visit the sight. Yet will it be euident that this is not all, but that the *Sphericall* roundnes of the water will proue a greater impediment where the distance is any thing greater. But for one of *Patricius* his shifts concerning vapours arising out of the Sea, (to which *Clavius* seemes also to consent in his Commentary vpon *Iohannes de Sacrobosco*) it makes more for our assertion then his. For that which is seen in a thick *medium*, according to the doctrine of the *Opticks*, seems greater in quantity, and by consequence neerer, and so higher then would otherwise appeare: as we see by experience, that the *Sunne* sometimes is scene of vs before it ascend about the *Horizon*, because of a refraction of it's beames in a *thicke matter*. Wherefore it were rather to be imagined, that a tower seen at Sea, or a ship from the land, through these thicke and grosse vapours, should appeare higher, and seeme neerer then if it met not with such vapours. Secondly, what is vrged concerning the trembling *light*, caused by a refraction of the Sun-beames in the water, is of no force: For although such a light might cause an impediment or hinderance to the sight; yet would not this decrement or hinderance bee by degrees and in such proportion as we find it to be corespondent, to wit, to the distance interposed. And much wonder it is that *Patricius* (as my learned Friend Mr *R. Hues* obserues) being, as it seemes very well read in the stories of *Spanish* nauigations, should not be conuincd out of the Nauigation of *Magellane*, who taking his iourney toward the *Southwest* parts, passed by the *Magellane* straights, now called by his name, and so returned by the *Cape of Good Hope* into *Spaine*, to which we may adde the voyages of *Drake*, *Candish*, and many others. The second reason is vrged by *Aristotle* in his 2^d book *de cælo*, and hath its ground in *Archimedes lib. 1. de Aqua-velitis*, which is formed in this

sort. The nature of the water is to affect and flow to the lower place, whence it must necessarily be inferred that it must be round, for otherwise it should not alwaies obtaine the lower place. The reason of the consequence shall be expressed in this



figure; for if we ascribe to the water a plain superficies, let it for example be $A \cdot D \cdot B$, and from the center of the earth C . let there be described a circle, to wit, $E \cdot G \cdot F$, then let there be drawne CD , a perpendicular line to AB , and let AC and BC be ioyned together. Now be-

cause the right line CD is lesse then CA , or CB , as wil appeare evidently by sense; it will be plaine that the point D will be in a lower place then the point A or B , because D is nearer to the Center; forasmuch as $D \cdot C$ is but a part of a beame of the circle whereas AC and CB evidently exceed that quantity or proportion. Another reason there is, commonly drawne from the roundnes of drops cast on the sand, as also from water in pots, whose superficies seemes to swell above the brimmes; but this reason, as we shall proue in place conuenient, is rather against this assertion then for it; because indeed, wee affirme the water to be round, but so as it claimes the same Center with the Center of the Terrene Globe; and therefore cannot be sensible in so little a portion, as a drop, or pot of water. This proposition being sufficiently proued by these two reasons; it is needfull in the second place that we answere certaine obiections cast in by the said *Patricius* against our assertion. Euery surface of the water (quoth *Patricius*) is either only plaine, or only round, or both plaine and round, or neither plaine nor round: First that it is not both plaine and round, seemes very eident, for so it should admit of contrariety: Neither can one part be plaine and another round, because the water is an vniforme and homogeneous body, not consisting of such vnequall parts: that it should neither be plaine nor round seemes more impossible, because few or none haue dreamt of any other figure. Lastly, that it is not round only, he labours to confirme by sundry reasons

sons and experiments. First, he testifies of himself, that sayling in the Sea, he plainly saw in the morning before Sun-rising, the Mountaines of *Corfica*; which afterward, as soone as the Sunne was risen, vanished out of his sight. Whence he concludes, that this proceedes not from the roundnes of the Earth, but from some other cause. But this argument to iudicious men wil seem very weake, 1 Because it depends altogether on the authority and credit of *Patricius*, whose assertion I take to be no better then another mans denial. 2^{ly} were this argument euery-where sound, yet would it proue no other thing, but that this effect were not to be imputed to the Sphæricall swelling of the Earth. Whence cannot be drawne any generall conclusion, that the *Earth* or *Water* is not *Sphæricall*. We deny not in the meane time, that other causes sometimes concurre, which may hinder or take away the sight of objects from those which saile on the Sea. The second experiment, *Patricius* describes in this manner. At a certaine Towne called *Comaclum* (saith hee) there is a very great poole; through which poole or lake some 3 yeares agoe, it was my chance to be carried in a boat. The bottome of the water almost all the way in all the iourney appeared to be lesse then 2 foot in depth from the top. The way increasing, at first the lower parts and foundations of houses, then the tops and princely pinnacles began to vanish from our sight: at last hauing scarce passed 6000 paces, a Tower 72 foot high began to appeare, as it were cut off by the middle, & from the middle part vpward appeared visible; but after 10000 paces it was taken out of sight: I would here aske the *Geographers* (quoth *Patricius*) whether in so short a distance, wherein the bottome for the whole space surpassed not two foot in depth, the water could ascend to 72 foot? Had it bin my chance to haue gone with *Patricius* ouer the lake, I might perhaps by obseruation of this experiment, haue giuen a more probable coniecture of the cause. Neuerthelesse being vnacquainted aswell with the place, as the truth of his obseruation, I may perhappes guesse somewhat at his errour. First then, whereas he auerres, that passing along for the space of a 1000 paces, a *Towre* of 72 foot high, seemed cut off by the midst, which at 10000 vanished

out of sight. I confesse that in so short a space the swelling of the water inter-posed, could not be so great as to hinder the sight, and be the cause of this effect: wherefore some other *Accidental* cause must be sought out. For the finding out of which to come as neere as I can, I would make inquiry, whether this passage of the *Boat* was directly *forward* from the *Towre* on the *Water*, no land inter-posed: or *Indirectly* side-wise, in such sort, as the shore might be placed betwixt their sight and the *Towre* mentioned: The former no wayes can be imagin'd; forasmuch as it not only contradicts the grounds of our receiued *Philosophie*; but also of *Patricius* himselfe: for giuing the *Earth* a *plaine* surface, or *Angular*, or any other forme, it were impossible that in so short a distance, such an effect should happen out of the figurature of the water. If the passage were *oblique* or *indirect*, in such wise as the shoare might any way inter-pose it selfe betwixt the *Boate* and the *Towre*, it were easie to imagine how such an experiment should happen: for the land by which the *Boat* might be carried, might haue an ascent by such *Degrees*, as the *Towre* at 1000 paces might be for the halfe of it obscured, and at last be altogether taken out of sight. This reason then of *Patricius*, seemes rather to be ascribed to the *Land* then the *Water*. The third reason of *Patricius* is drawne from the *Homogeneity* of the *Water*. If the water (saith he) haue a round *superficies*, the parts of it would challenge the like figure, because in *homogeneall* bodies, the same reason is to be giuen of the *whole*, and of the *parts*: But the parts of the water are not *Sphæricall*, as may be proued by diuers instances: 1. Because water in the mouth of a pot, seemes not to haue any such *Sphæricall* roundnes: for although at the brinke it seeme to bee restrained aboue the pot, yet no such swelling appeares in the middle. 2.^{ly} That riuers are kept in by their bankes, which otherwise would flow abroad. 3.^{ly} That riuers, when by the melting of snow, they swell so great, as they can hardly be contained within their bankes, doe not seeme higher in the middle, then in other places. 4.^{ly} If any man from one side of the riuier to the other, leuels at any mark, he may surely hit it: which he should not doe, if there were any *Sphæricall* swelling in the midst,

midst, which might hinder the sight. 5^{ly} and lastly it seemes so vnlikely, that the water should rise in the midst, that it is more probable it should be more hollow; in that we plainly obserue that all filth and rubbish carried from the bankes into the riuer, is wont to settle and swimme in the midst. Notwithstanding all these arguments of *Patricius*, our ground is yet vnshaken; 1 Concerning small drops, and water in the mouth of pots; it is found to be round and Spharicall, though not exactly: the reason whereof we shall declare hereafter. This roundnesse, I confesse, serues not any way to the confirmation of this assertion, because the *Spharicity* and roundnes which we averre to be in Water, hath for its center, the center of the whole Earth: and therefore in so small an arch or section, as the bredth of a pot, or a drop of water, cannot possibly haue any sensible appearance or existence. And we must needs confesse, that this experiment was very fondly vrged to this purpose by some of our *Geographers*, and such as stands not with any demonstration. Which granted, sufficiently answeres all the reasons last vrged by *Patricius*, except the last. Forasmuch as he requires in the Water, a sensible appearance of this roundnesse in euery riuer or litle parcell of water, which cannot be admitted. Touching the last thing which he vrgeth, that all the rubbish and filthy matter, is from the bankes carried into the middle, whence he would inferre the middle to be hollow and lowest; we can answer diuers wayes: 1 That this experiment is not alwayes certaine, because euery man may oftentimes see the contrary; to wit, that such filthy rubbish rather vseth to cleaue to the banks of the riuer, then to float into the midst. 2^{ly} That if any such thing happen, it is because of the torrents which run violently from the banks into the midst, carrying with it such things as are light, the steepnesse of the place being greater, the current wider or swifter. But nothing here can be concluded to proue the water according to his naturall force, to bee either plaine or hollow in the midst, which this Adversary vndertook to demonstrate.

C H A P. III.

*Of the Partiall magneticall affections in the
Spheare of the Earth.*

Hitherto haue we discoursed of such Affections of the Terrestriall Spheare as are *Elementary*, and knowne heretofore to ancient Philosophers: It followes in the next place that we treat of *Magneticall* affections, to wit, such as follow the magneticall nature of the Earth.

Of the *vertue* and propriety of the *Load-stone* many haue written, but few sought out the true nature. The invention of it is attributed to a certain heards-man, who hauing his shooes shod with iron, and an iron pike in his hand, resting himselfe on a quarry of *Loadstone*, could hardly remoue himselfe fro thence. But this seemes rather a pleasant *Poeticall* invention, then a true History, hauing no good Author to auouch it. But to let passe the first Invention, being a matter rather indebted to *chance* then *industrie*; no small difficulties haue discouered themselves in the invention and finding out, of the causes of *Magneticall* properties. Somewhat, I confesse, hath bin written of such magneticall affections as haue bin most knowne; such as is the vertue *Attractione*, by which it drawes to it selfe iron, or Steele; as also the vertue *Directiue*, by which a needle touched with the *Magnet*, directs and conformes it selfe North and South. The rest of *Magneticall* proprieties I find in ancient Writers, as litle knowne as their causes; & if any matter herein were broached, it was merely coniectural, and depending on no certain demonstration: neither had we any certain or satisfactory knowledge

of this thing, vntill such time as it pleased God to raise vp one of our Countrymen *D. Gilbert*, who to his euerlasting praise hath troden out a new path to *Philosophie*, and on the Load-stone erected a large *Trophie* to commend him to posterity. This famous Doctor being as pregnant in witty apprehension, as diligent in curious search of naturall causes: after many experiments, and long inquiry, found the causes of most magneticall motions and proprieties hid in the magneticall *temper* and constitution of the *Earth*, & that the Earth it selfe was a meere *Magneticall* body challenging all those proprieties, and more then haue expressed themselues in the Load-stone. Which opinion of his was no sooner broached, then it was embraced and wel-commend by many prime wits, aswell *English* as *Forraine*. Insomuch that it hath of late taken large root, and gotten much ground of our *vulgar Philosophie*: Not that in the maine scope and drift of it, it contradicts or crosses all *Peripateticall* principles, or the most part of such grounds as haue hitherto borne the stampe aswell of *Antiquity*, as of *Authority*: But that it hath brought to light matters of no small moment, which neuer found any ground or footsteppes in our ordinary Philosophie. This new Philosophie I dare not commend as euery-where perfect and absolute, being but of late yeares invented, and not yet brought to mature perfection: yet would it saueur of little ingenuity or iudgment in any man, peruersely to deny all such Magneticall affections in the Earth as are grounded on plaine experiments and obseruation: sith no Philosophie was euery-way so exact, but required experience dayly to correct it. I intend not here an absolute discourse of *Magneticall Bodies* and *Motions*, but leaue it to their search whose experimentall industrie is more suteable to such a subiect. Onely I will shew some generall grounds appertaining to the constitution of the *Terrestriall Globe*, which I hold necessary for a *Geographer*. Wherefore ere I curiously distinguish these Magneticall proprieties of the Earth into other seuerall kindes, I will set down this Theoreme, as a ground or foundation of that which follows.

I *The Terrestriall Spheare is of a Magneticall nature and disposition.*

A *Magneticall* Body by some is defined to be that which seated in the Aire, doth place it selfe in one place *naturall*, not alterable. This situation is supposed to agree to all the Starres, especially to the great Globes of *Saturne*, *Iupiter*, *Mars*, and the *Sunne*; as also to such as giue their attendance on them, lately detected by the Trunk-spectacle; to wit, those two Starres which moue about *Saturne*, the foure which moue about *Iupiter*, the two which circle about the *Sunne*, as *Venus* and *Mercurie*; and lastly the *Moone*, which encompasseth the Spheare of the Earth. But to let passe those other Globes, as farther off, and therefore lesse subiect to our search: our discourse shall onely touch the Earth whereon we liue, which we shall proue to partake of a certain Magneticall vertue or inclination: which to shew more openly, we must vnderstand, that all Magneticall Globes haue some parts of their bodies which be also Magneticall, which being diuorced from their proper Spheare, & meeting no obstacle, will settle themselues to the naturall situation of their peculiar *Orbes*. Which we may plainly perceiue in the Spheare of the Earth, wherein we shall find two *Magneticall* minerals; whereof the one is the *Load stone*, attracting iron or Steele; the other the *Iron* or Steele it selfe: either of these two, artificially hanged in the Aire, or placed in a litle boat on the water, all incombrances being remoued, will conforme and settle their *parts* and *Poles* correspondent to the poles and parts of the Terrestriall Spheare, as *North* and *South*. This hath bin found in all parts of the Earth by such as haue trauelled round about her, as *Drake* and *Candish*, whose Compasses were alwayes directed Magnetically in all places which they passed: which we cannot ascribe to any other cause then the *disponent* faculty of the Earth's Magneticall Spheare, as shall appeare hereafter by demonstration. Moreouer it hath bin obserued by such as saile *Northerly* and *Southerly*, that the Magneticall *Inclinary* needle, in euery eleuation of the Pole is conformed and disposed to the Axell of the Earth, according to certaine angles answerable

to the latitude of the Region, as we shall shew hereafter. This diuersity of conformity must necessarily arise, either from the *Magneticall* instrument in it selfe *absolutely* considered, or els from the *Harmony* and correspondencie it hath with the Terrene Globe. It cannot be the first; because it should be the same in all places and Regions of the Earth, which is contrary to experience, and our supposition. Then must we needes deriue it from the Magneticall *disponent* vertue of the whole Globe of the Earth, from which vertue the whole Earth may be called Magneticall. Nay if we truly consider, these Magneticall affections *primarily* agree to the Earth, as the mother of all Magneticall bodies; but afterward *secondarily* are deriued into the parts; because (as *Gilbert* relates it) the cause of magneticall motions and affections is the magneticall *forme* of a *Sphericall* Globe; which forme first agrees to the whole Globe of the Earth, and so is deriued to all his *homogeneall* parts. These parts are called *Homogeneall*, not in regard of their *Matter* and *quantity*, but in respect of their *Magneticall nature* and *communion*, which in euery part is conspicuous. If any man should wonder why the Earth should be called Magneticall in regard of this minerall, which seemes one of the least and scarcest substances whereof it consisteth; we may many wayes answer: First, that although the surface of the Earth seemes for the most part composed of other materials, more convenient for the vse of liuing Creatures which dwell therein: yet may infinite rocky mines of Magnets be couched lower toward the center, which strengthen and consolidate the Earthly Globe. Secondly, we must not imagine the Magneticall substance of the Earth, to be all one kind of stone, but various: for somewhere it is hard & solide as the true magnet it selfe and the iron, which is nothing els but a mettall decocted out of the Load-stone; (for *iron Ore* differs litle or nothing at all from the *Load-stone* it selfe) somewhere againe, this substance is more thinne and fluid; being lesse concocted as some kinde of *clay*, and certaine *vapours* arising out of the Earth, which be magneticall: which being brought to a harder and more massie substance, will haue the same affections and motions with the Loadstone it selfe. This

assertion of the Earth's magneticall nature, we shall confirme more evidently hereafter, where we shall proue both the *Poles*, the *Meridians*, *Parallels*, and other circles, to be not bare *Imaginary* lines, as some haue thought (but to be *Really* grounded in the magneticall nature of the Earth, and are to be shewed in any round Loadstone, wrought and placed conveniently with instruments thereunto applyed.

2 The Magneticall affection of the Earth is twofold, either *Radicall* or *Deriued*. The Radicall disposition we call that which is the first root and ground of all other magneticall motions.

3 The Radicall vertue or inclination is again twofold, either *Motue* or *Disponent*. The Motue is that by which all magneticall bodies are inclined and stirred vp to the motion.

In the *Reasonable* soule of a man, wee haue two faculties which shew themselves; a *motue*, and a *directiue* or disponent powers: whereof the one stirres vp the motion, the other regulates, conformes, and directs it: The former is the *Will*, the later the *Discourse* and Iudgment. This distinction of faculties, howsoeuer more eident in the soule, findes place in all *Naturall* agents: in which a Philosopher ought to distinguish betwixt that which giues them a power to moue, and that which limits, determines, and (as the Schoolemen are wont to speake) *modifies* the action. Amongst others the magnet stone seemes most to partake of these two powers, as that which amongst all naturall agents (in *Gilberts* opinion) seemes most to haue resemblance with the soule of a man: so that by an apt Trope it hath bin called of many, the Magneticall soule of the Earth; for hence we may well perceiue one vertue or inclination, which causeth the magneticall needle to moue out of its place; another

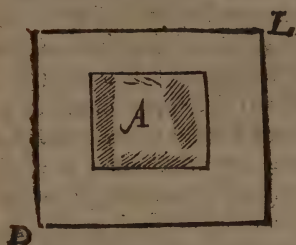
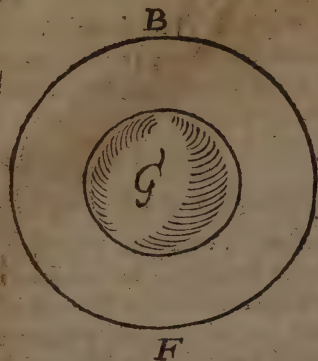
other by which it is apt to conformance it selfe North and South, as also to obserue certain angles correspondent to the latitude of the place, as shall be demonstrated in due place. Of the motiue power we will produce these Theoremes.

I *The Magneticall motion is excited in a small and vnperceivable difference of time.*

This proposition may be shewed out of euident experiment, wherein euery mans sight may be a witnes. For if an *Iron needle* touched with the *Loadstone*, be placed within the Spheare of the magneticall vertue of the stone, it will presently moue it selfe, notwithstanding the interposition of solide bodies, which made *Gilbert* to imagine this motion to be effected by a meere *spirituall* and *immateriall* efflux, which may well be compared to the *light*, which neuertheless it surpasseth in subtility: for the light is moued from East to West so quickly, insomuch as many haue thought this motion to haue bin in a *moment* or *instant* of time. But this quicknes of motion may much more be imagined in the Magneticall vertue, being of a more subtile and piercing nature, as may be gathered from this reason, to wit; That the light is alwayes hindered by the interposition of a *thick* and *opaque* body; but the vertue Magneticall findes a passage through all solide bodies whatsoeuer; and meetes with no impediment.

2 *This Motiue qualitie is sphaerically spread through euery part of the Magneticall body.*

Here againe may we finde a great resemblance betwixt the magneticall vertue and the *light*; for as all light Bodies, as the *Sunne*, *Moone*, and *Starres*, cast their beames euery way into an orbicular forme: so this Magneticall vigour casts it selfe abroad not only from the center toward the *superficies*, but from the *superficies* outward into the *Aire* or *Water*, where this magneticall body is placed, and so makes vp a Spheare; but yet with this difference, that if the body be meere and perfectly Sphaericall, the Orbe of the magneticall vertue will end in a perfect Spheare, as we see the magnet *G* to confine his vertue within



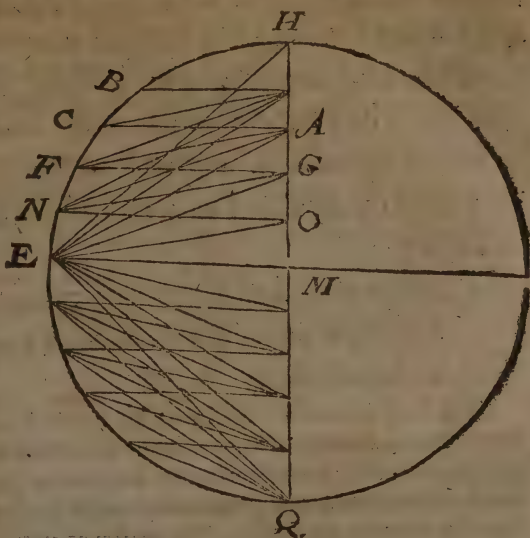
within the Circle B F. But if it be a square, or any other figure not Sphæricall, it imitates a Sphære as neare as the body will suffer, in that it spreads it selfe euery-where from the center by right lines; yet will it be confined in a square figure correspondent to the body, whence it proceeds, as we see the vertue of the square magnet A, to cast his beames into the square figure L D.

3 The motiue quality of the Magneticall body is strongest of all in the Poles, in other parts by so much the stronger by how much these parts are situated neare the Poles.

We suppose out of the principles of Magneticall Philosophie, that a Magnet hath two *Poles*, whose vse we shall shew hereafter. These *Poles* are found by experiment to haue more force and vigour in them then other parts, and all other parts to enioy more or lesse force, by how much nearer or farther off they are situated to their Poles. The reason is ascribed by these Writers to the disposition of the *Magneticall* vigour in the body of the Loadstone, as shall appeare by this figure following in *Gilbert*, expressing the great *Magneticall* Body of the earth. Let the Sphæricall superficies of it be H Q E, the Pole E, the Center M: H Q. the plains of the *Equinoctiall*; from euery point of this *Equinoctiall* plaine, the vigour Magneticall is conveyed and extended to C F N E; and to euery point from C to E the Pole; but not towards the point B, so neither from

G

G towards
C. The vi-
gour is not
strengthened
in the part F
H G, from
that which
is G M F E;
but F G
H doth in-
crease the
vertue in H:
so that there
can arise no
vigor so far
from the pa-
rallels to the
Axel-tree
about the



said parallels, but internally from the parallels to the Pole. So we see that from every point of the *Equinoctial* plaine, the force is deriued to the Pole E. But the point F hath onely the vigour from G H, and the point N from O H: but the Pole E is corroborated and strengthened from the whole plaine of the *Equinoctial* H Q. Wherefore the vigour magneticall in this Pole is most eminent and remarkeable, but in the middle spaces; as for example in F, the magneticall quality is so far strengthened, as the portion of the *Equinoctial* plaine H, can giue. But Dr *Ridley* in his late Magneticall Treatise, in the 6 Chapt. seemes to oppose this Demonstration. For although hee acknowledgeth that the vigour is strongest of all in the Poles; yet (saith he) if tryall bee made what the Pole will take perpendicularly; and also what the parts about 34 degrees will lift vp, it will appeare to be halfe as much perpendicularly; so that the Pole doth not take vp as much, as this and the other part doth on the other side. But the decision of these differences I leaue to such as are more experimentall then my selfe, being

destitute of those helps and instruments which they enjoy.

4 It behoues vs in the second place to speake of the Disponent vigour of Magnetical bodies. The Disponent force we call, that facultie by which magneticall Bodies are disposed or directed to a certaine site or position.

1 *Magneticall bodies moue not vncertainly, but haue their motions directed and conformed to certaine bounds.*

This Proposition is confirmed by manifold experiments. For *magneticall* bodies are neuer found to moue vncertainly, &c at all adventures, but conforme themselues to certaine Poles; and make certaine angles *proportionall* to the *latitude*, as we shal shew hereafter in particular. The reason of which experiment we can draw from no other cause, then the first institution of Nature in all Naturall agents, which she would haue directed to certaine ends, that nothing in her Common-wealth might seeme idle or vnecessary; wherefore she giues all agents not only a *power* to worke their ends; but also shewes them the *way*, squares and regulates the meanes which direct vnto the end. No-where is this *directiue* power more remarkeable, then in magneticall bodies, especially in their *Direction* and *Variation*, motions treated of hereafter in place convenient; to which for a further confirmation of the Theoreme, wee referre the Reader.

9 The Radicall facultie of the magneticall body being somewhat spoken of, as well in their motiue, as disponent vertues. We are in the next place to speake of the deriued motions, which arise out of these faculties.

6 These

- 6 These motions magneticall are either *partiall*, or *totall*. The partiall we call that by which the parts of the Earth are magnetically moued and conformed as well one to the other, as to the whole terrestriall globe.
- 7 The magneticall partiall motions are *Coition*, *Direction*, *Variation*, and *Declination*. Magneticall Coition is that motion by which magneticall bodies are ioyned and apply themselves one to the other.

For the knowledge of this magneticall motion, we need goe no farther then the *Iron* and *Steele*, which we shall obserue to moue vnto the Loadstone, and cleaue vnto it, if so be it be placed within the Sphære of his vertue. This motion is commonly called *Attraction*, but improperly, as is obserued by D. Gilbert. 1 Because *Attraction* seemes to suppose an externall force or violence, by which one thing is carried and moued vnto another: but the *Coition* is meerely naturall, as proceeding from the internall forme of both the bodies. 2 Attraction supposeth the force of mouing to be onely in the one party, and the other to be meerely passiue, and not actiue concurring to this motion; whereas in the magneticall coition, both parts are mutually inclined by nature to meet and ioine themselves one to the other. Not that the force of motion in both parts is alwayes equall: because one magneticall body is greater and stronger then the other, and then the one part seemes to stand still and draw the other vnto it, although there be in this part so resting an inclination to the other; which mutuall inclination of conjunction in magnets, we may easily see in two magnets of equal quantity and vertue, which being set at a convenient distance, will so moue, that they will meet in the mid way. Some haue gone about to parallell this *Attractive* force of the Loadstone with the *Attractive* force of *Teat* or *Amber*, which we see by a

naturall vertue to draw vnto it selfe litle strawes, and other such like matter. But he that truly vnderstands the nature of a magneticall body, shall finde a great disparity: First, because the Ieat or Amber which are comprised vnder the name of *Electrical* bodies, drawes vnto it by reason of his *Matter*: whereas otherwise the cause of the *Magneticall Coition* is to bee sought in the *forme*, as being too subtile a thing to spring from a materiall substance. Secondly, *Electrical* bodies draw and attract not without rubbing and stirring vp of the matter first; & presently faile, if any vapour or thick body should be interposed. But in a magneticall motion we find no such matter, because it requires no such preparation or rubbing of the stone, nor is hindred by interposition of solid bodies, as we proue in this place. Thirdly, the Loadstone moues and prouokes to motion nothing els but other magneticall bodies; but the *Electrical* will draw any litle thing, as straw, haire, dust, and such like. Fourthly, the Magnet will lift a great waight according to his vertue and quantity; but Ieat the smallest and lightest things. Lastly, the *Electrical* bodies, as *Gilbert* well confirms by experiments, draw other bodies vnto them by reason of a *moist* effluence of vapours, which hath a quality of ioyning bodies together: as we see by the example of two stickes in water at a certaine distance, which will commonly moue till they meet together. But the *magneticall coition* cannot be other then an act of the magneticall forme. Of the cause of it many Philosophers haue freely spent their vncertaine coniectures, rather out of a feare to be esteemed ignorant, then of confidence to be accounted learned. Most run vpon the forme of the mixt body, which growes from the composition of the foure Elements; but this opinion is very feeble, and cannot goe without crouches: for sith all mixt formes grow out of the temperament and disposition; they adde nothing to the thing compounded, but diuersly modificate what was before in the simple Elements; it cannot bee imagined how such an affection as this should bee onely found in the magnet, & no other mixt body. Indeed we ascribe this affection to the *forme* as the immediate cause; but by this *forme* we vnderstand not the forme of the *mixture*, resulting out

of the mixture and temperature of the foure qualities; but the *magneticall* forme of all globous bodies, such as are the *Sunne*, *Moone*, *Starres*, and this *Terrestrial Sphaere* whereon we live, whose natures receiued the *stampe* in the first creation for the preservation of this integrity. He that shall seeke for the originall of all *formes* of this kinde in the *mixture* and *constitution* of the foure Elements, shall labour much, and finde little, and neither at last be able to content himselfe, or instruct others; except we suppose a man sufficiently taught when he heares ordinary matters expressed in *exoticke* and artificiall termes. For my owne part, I content my self with a rule of *Biel* the Schoolman; That when an immediate effect proceedes from an immediate cause, we ought not to search farther why such a cause should produce such an effect. Euery man being demaunded why the *fire* is *hot*, is ready to flye to the *forme* of *fire*, and alleage this as the cause: but should he inquire further, why the forme of fire should be the cause of heat, he might perhappes puzzell a whole Academie of Philosophers, and neuer proue himselfe the wiser. For the further illustration of this motion, these Theoremes will seeme necessary.

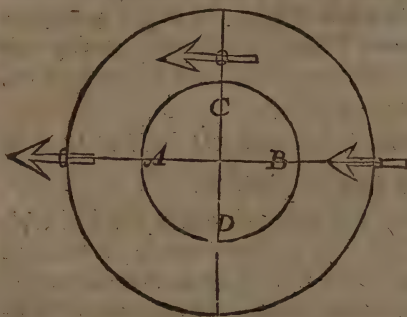
I *The Magnet communicates his vertue to iron or Steele if it be touched with it.*

Experience teacheth that any iron instrument, touched with the Loadstone, receiues instantly the same vertue *Attractive*. But the manner how this vertue should be communicated on so sleight a touch, hath bin controuerted. The common *Philosophers* haue imagined, that certain litle parts of the Loadstone are separated from it in the touch, which cleauing to the iron or Steele, cause this Attraction. But that this vertue cannot be communicated by any *corporall* processe, or any such litle parts cleauing to the iron, is not so easie to imagine: for first it seemes impossible, that with a bare touch, these parts should be separated from the magnet, or at least should bee so fast linked to the iron. Secondly, these parts being so litle and insensible, cannot haue so much vigour as wee see an Iron will haue at the touch of the Loadstone. Thirdly, the Loadstone can worke vpon
the

the iron notwithstanding any body interposed, which is an evident signe that the iron it selfe is of a magneticall temper. Wherefore to shew a reason of this effect, we say; That *Iron* is a mettall excocted out of the Loadstone; which albeit it retaines in it selfe the vertue of the Loadstone, yet by reason of the liquescfaction, is altogether languishing, and as it were buried; but vpon touch of a Loadstone, is stirred vp to his former vigour: for the magnet insinuates his *Incorporeall* influence into the *iron*, and so rectifies and animates that force which was almost dead.

2 The magneticall Coition is strongest of all in the Poles.

This may easily be demonstrated by an experiment: for if the iron needle which is proposed to bee *Attracted*, and the *Poles* and *Center* be placed in the same right line; then this *Coition* will be to a *perpendicular*, as in A and B,



to wit, the *Poles* in the Diagramme: but in the middle space they will obliquely respect and point: and by how much farther off from the *Pole* it is, by so much is this vertue weaker: but in the *Æquator* it selfe it be-

comes meere parallel without any inclination at all. To know in what proportion this force is increased or weakned, we must put another ground; That the force of this coition is increased proportionally as the chords of a circle: for by how much the least chorde in a circle differs from the *Diameter*, so much the forces *Attraction* differ from themselves. For sith the *Attraction* is a Coition of one body with another, and magneticall bodies are carried by a convertible nature: it comes to passe that a line drawne from one Pole to another in the diameter, direct-

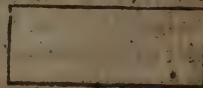
ly meetes with the body, but in other places lesse, so that the lesse it is converted to the body, the lesse and weaker will be the coition.

8 So much be spoken of the magneticall *Coition*: It followes that we speake of Magneticall *Direction*, which is a naturall conversion & conformity of the magneticall bodies to the Poles of the Earth.

It is manifest that a magneticall body so seated, that it can moue without any impediment, will turne it selfe in such wise, that the one Pole of it will respect the *North* Pole of the Earth, the other the *South*, which motion we call *Direction*. This wee may plainly see in a Marriners compasse, whose *Lilly* alwayes respects the *North* point. If a compasse be wanting, the same may be shewed in a litle *corken-boate*, which being put in the water with a *load-stone* in it, will so turne and convert it selfe, that the Poles of the *Load-stone* will at length point out the Poles of the *Terrestriall Globe*. The manner how, shall be disclosed in these Theoremes.

I *The South part of the Load-stone turnes to the North, and the North part to the South.*

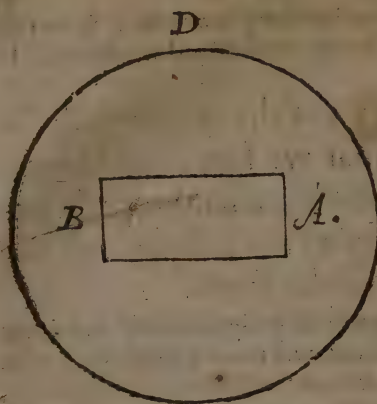
To confirme this assertion, some haue produced this experiment. Let there bee cut out of a rock of *Load-stone*, a *Magnet* of reasonable quantity. Let the two Poles both *North* and *South* be marked out in the *Load-stone*, the manner of which, we shall perhaps teach hereafter: then let it be put in a corken litle boat on the water, so that it may freely float hither & thither: It will be euident that that part which in the rock or Mine pointed *Northward*, will respect the *South*, and contrarywise the *South* part will respect the *North*; as we may see in this figure: Let the *Magnet* as it is continuatd with the Mine or *Globe of the Earth* be *AB*, so that *A* shall be in the *North*



B

H

pole



pole, B the *South Pole*. Let this Load-stone be cut out of this rocke or Mine, and placed on the water in a little timber boat, which shall be CD: we shall find that this little dish or boat will turne it selfe so long, vntill the *North* part A, be turned to the *South* part B: and on the other part, the *South* part B, be converted to the *North* part A: and this conformity would the whole rock of Load-stone claime, if it were diuided and separated from the

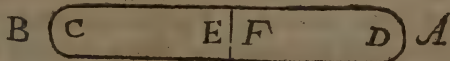
Globe of the Earth. The reason why the magnet in the boat on the water, turneth, windeth, and seareth it selfe to a contrary motion to that it primarily receiued, whiles it was ioyned to the bowels of the Earth, and vnited to the body of the great Magnet, is; because euery part of a Load-stone being separated from the whole, whereof it is a part, becomes of it selfe a perfect, compleat, magneticall body, (as we may say) a little Earth, hauing all the properties of the great Globe, as *Poles, Meridians, Equators, &c.* And therefore according to the nature of magneticall vnion, spoken of in our next Theoreme, will in no wise endure to settle it selfe as it did before; but deemes it a thing more naturall, and of more perfection, to turne his aspect a contrary way, to that which he inioyed at his first constitution. Here may we note a great error of *Gemma Frisius*, who in his corollary vpon the 15 Chap. of his *Cosmographical* Comment on *P. Appian*, affirmes; that the Needle magnetically affected, would on this side the *Equator*, respect the *North-pole*; but being past the Line, would straightway turne about, and point to the *South-pole*: An error (as *Mr Hues* saith) vnworthy so great a Mathematician. But *Gemma Frisius* in some sort,

sort, may be excused; forasmuch as the grounds of magneticall Philosophy, were in his time either not discovered, or most vnperfectly knowne, and the vncertaine relations of Navigators were reputed the best Arguments: and how easie a matter it is for a Trauailer in this sort to deceiue a Scholler, who out of his reading and experience can shew nothing to the contrary, let euery man iudge.

2 *This contrary motion here spoken of, is the iust conflux and conformity of such bodies to magneticall vniou.*

This is demonstrated by *Gilbert* in this manner. Let the whole magneticall body be C D, then C will turne to the North of the Earth B, and D vnto the South part A. Let this magnet be cut

in twaine by



the middle line

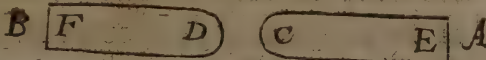
or *Aequator*,

and the point

E will tend to

A, and the part

F, will direct it



selfe to B: for as in the whole, so in the parts diuided, nature desires the vnion of these bodies. The end E willingly accords with F; but E will not willingly ioyne it selfe with D, nor F with C, for then it would haue C, against its nature, to moue toward A the South, or D in B, which is the South. Separate the stone in the place of diuision, and turne C to D, and they will conveniently agree and accord; for D will turne it selfe to the South as before, and C to the North; and E and F ioynt parts in the minerall or rock, will now be most sundred. For these magneticall parts concur and meet together not by any affinity of *matter*, but receiue all their motion and inclination from the *forme*; so that the limits, whether ioynt or diuided, are directed magnetically to the Poles of the Earth, in the same manner, as in the diuided body.

- 3 If any part Southward of the magneticall body be torne away or diminished, so much shall bee also diminished of the North part; & contrariwise if any part be taken away in the North-part, so much shall the Vertue of the South-part be diminished.

The reason is, because the Magnet hauing eminently in it the circles which are in the Earth, is separated or diuided by a middle line or *Equator*, from which middle space the vertues are conveyed toward either Pole, as we haue before shewed. Now any part being taken away from the North or South part, this *Equator* or middle line is remoued from his former place into the midst of the portion which is left, and so consequently both parts are lesse then before: For although these two ends seeme opposite, yet is one comforted and increased by the other.

- 9 Of the motions of Coition and Direction we haue handled. It followes that we speak of the motions of the second order, to wit, *Variation, and Declination.*

- 10 Variation is the deviation or turning aside of the directory Magneticall needle from the true point of North, or the true Meridian towards East or West.

In the discourse immediatly going before, hauing treated of the magneticall body, we haue imagined it to be true, and pointing out the true North and South points of the Terrestrial Globe; which certainly would be so, if the substance of the Earthly Globe were in all parts and places alike, equally partaking the Magneticall vertue, as some round Loadstones; neither should we find any variation or deviation at all from the true Meridian of the Earth: But because the Terrestrial Globe

is.

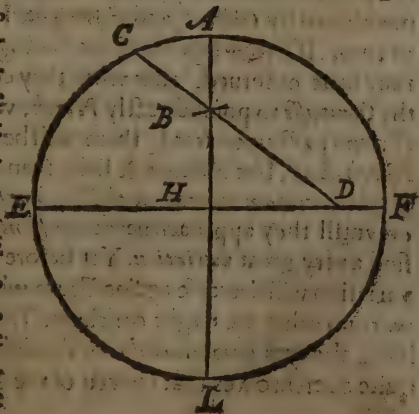
is found by Navigatours to bee vnequally mixed with many materialls, which differ from the magneticall substance, as furnished with rockie hills, or large valleyes, continents, & Ilands, some places adorned with store of iron Mines, rockes of Loadstone, some altogether naked & destitute of these implements; it must needs fall out, that the magneticall needle & compasse directed & conformed by the Magneticall nature of the Earth, cannot alwayes set themselves vpon the true Meridian, that passeth right along to the *Poles* of the Terrestriall Globe; but is forced and diuerted toward some eminent and vigorous magneticall part; whereby the *Meridian* pointed out by the magnet, must needs varie and decline from the true *Meridian* of the Earth, certaine parts or degrees in the *Horizontall* circle; which diuersion we call the *Variation* of the compasse: so that *Variation*, so far as it is obserued by the compasse, is defined to be an *Arch* of the *Horizon*, intercepted betwixt the common intersection with the true *Meridian*, and his *deviation*. This effect proceeding from the Inequality of magneticall vertue scattered in the Earth, some haue ascribed to certaine Rockes, or mountaines of Loadstone, distant some degrees from the true Pole of the World; which rockes they haue termed the Pole of the Loadstone, as that whereunto the magnet should dispose and conforme it selfe: which conceite long agoe invented, was afterward enlarged and trimmed out by *Fracastorius*. But this opinion is a meere coniecture, without ground: for what Navigatours could he euer produce that were eye-witnesses of this mysterie? or how can he induce any iudicious man to belecue that, which himselfe, nor any to his knowledge euer saw? The relation that the Frier of *Norwegia* makes of the Frier of *Oxford*s discovery, recorded by *James Cuius* in the booke of his Trauels, where he speakes of these matters, is commonly reiected as fabulous and ridiculous; for had there bene any such matter, it is likely he would haue left some monumētts of it in the records of his owne Vniuersity, rather then to haue communicated it to a friend as farre off as *Norwegia*. Moreouer the disproportion in the degrees of *variation* in places of equal distance, will easily correct this error, as we shall shew in due

place. More vaine and friuolous are all the opinions of others concerning this magneticall variation: as that of *Cortesi*, of a certaine motiue vertue or power without the Heauen; that of *Marſilius Ficinus* of a ſtarre in the Beare; that of *Petrus Peregrinus*, of the Pole of the world; that of *Cardan*, of the riſing of a ſtarre in the taile of the Beare; that of *Beſtardus Gallus*, of the Pole of the *Zodiacke*; that of *Livius Sanctus*, of a certaine magneticall Meridian; of *Francis Maurolycus*, of a magneticall Iland; of *Scaliger*, of the heauen and mountaines; of *Robert Norman*, of a reſpectiue point or place: All which Writers ſeeking the cauſe of this variation, haue found it no further off then their owne fancies. More probable by farre, and conſonant to experience, ſhall we finde their opinion, which would haue the cauſe of this variatiō be in the Inæquality of the magneticall Eminencies ſcattered in the Earth. This Inæquality may be perceiued to be twofold. 1 in that ſome parts of the Earth haue the magneticall minerals more then other parts; forasmuch as the *ſuperſicies* of ſome parts is ſolide Earth, as in great Continents: 2, Becauſe although the whole Globe of the Earth is ſuppoſed to be magneticall, eſpecially in the Internall and profound parts: yet the magneticall vertue belonging to thoſe parts, is not alwayes ſo vigorous and eminent as in ſome other parts: as we ſee one Loadſtone to be ſtronger or weaker then another in vertue and power: but of thoſe two, the former is more remarkeable, which may be ſhewed by experience of ſuch as haue ſailed along many ſea coaſtes: for if a ſea-iourney be made from the ſhore of *Guinea* by *Cape Verde* by the *Cannarie* Ilands, the bounds of the Kingdome of *Morocco*, from thence by the confines of *Spaine*, *France*, *England*, *Belgia*, *Germany*, *Denmark*, *Norvegia*: we ſhall find toward the Eaſt, great and ample Continents; but contrarywiſe in the Weſt a huge & vaſt Ocean; which is a reaſon that the magneticall needle will varie from the true point of the *North*, and inclines rather to the *Eaſt*; becauſe it is more probable that theſe Continents and Lands ſhould partake more of this magneticall minerall, then the parts couered with the Sea, in which theſe magneticall bodies may be ſcarcer, or at the leaſt deeper buried, and not ſo forceable.

forceable. On the contrary part, if we saile by the *American* coasts, we shall rather find the *variation* to be Westward: as for example, if a voyage be made from the confines of *Terra Florida*, by *Virginia*, *Norumbega*, and so Northward, because the land butteth on the West: but in the middle spaces, neare the *Canary* Islands, the *directory* needle respects the true Poles of the Terrestriall Globe, or at least shewes very litle variation. Not for the agreement of the *Magneticall* Meridian of that place with the true, by reason of the Rock of Loadstone, as some haue imagined: because in the same *Meridian* passing by *Brasile*, it falls out farre otherwise: but rather because of the Terrestriall Continents on both sides, which almost diuide the *Magneticall* vigour, so that the *Magneticall* needle is not forced one way more then another; the manner whereof we shall finde in *D. Gilbert* expressed in an apt figure, to whom for further satisfaction I referre the Reader.

I The *Magneticall* variation hath no certaine Poles in the Terrestriall Globe.

It is but a common-receiued error (as we haue mentioned) that there is a certaine Rock or Pole of Loadstone, some degrees distant from the true Pole of the world, which the *Magneticall* needle in it's *variation* should respect. This Pole they haue imagined to be in the same *Meridian* with that which passeth by the *Azores*, whence they haue laboured to shew the reason why the *Compass* should not vary in that place: which they expaine by this Figure. Let there be a circle describing the Sphere, *E F*, the Horizon, *E F*, the Articke Pole *A*, the Antarticke *L*. The Pole or Rock of Loadstone



Stone placed out of the Pole of the Earth B. Let there be placed a magneticall *directory* needle in H; it will (according to their assertion) tend to the point B, by the magneticall Meridian A H B; which because it concurreth with the true Meridian B A, or H A, there will be no variation at all, but a true direction to the North Pole of the Earth. But let this magneticall needle be placed in the point D, it is certaine, according to this opinion, that it will tend to the Pole of the loadstone B, by the magneticall Meridian D B. Wherefore it will not point out the Pole of the Earth A, but rather the point C; because these two Meridians come not into one and the selfe-same. Hence they have laboured with more hope then successe, to find out the *longitude* of any part of the Earth, without any obseruation of the Heauens: which I confesse might easily be effected, if this conjecture might stand with true obseruation. But how farre this conceit swarues from the experience of Navigatours, one or two instances will serue to demonstrate. For if the *variation* had any such certaine poles as they imagine, then would the *Arch of variation* be increased or diminished proportionally according to the distance of the places. As for example; If in the compasse of an hundred miles, the Compasse were varied one degree, then in the next hundred miles it would vary another degree, which would make two degrees. But this hath often bin proued otherwise by diuerse experiments of Navigations, mentioned by *Gilbert*, and *E. Wright*. I will onely produce one or two. If a ship saile from the *Sorlinges* to *New-found-land*, they haue obserued, that when they come so farre as to finde the Compasse to point directly *North*, without any variation at all; then passing onward, there will be a *variation* toward the *North-East*, but obscure & litle: then afterward will the *Arch* of this *variation* increase with like space in a greater proportion, vntill they approach neare the *Continent*, where they shall find a very great *variation*. Yet before they come ashore, this *variation* will decrease againe. From which one instance, if there were no other, we might conclude; That the *Arch* of *variation* is not alwayes proportionable to the *distance*: which granted, quite ouerthrowes that conceit of the Poles of *variation*. Be-

line drawne from the Center E, which shall be E D. This line E D will be the true Meridian for that place, on which when the shadow of the gnomon shall happen to fall, we may assure our selues that it is full Noone.

7 The Magneticall Inuention is performed by the Magneticall Directorie Needle.

This way is subiect to much error, and not so certaine as the former, because (as we haue shewed before) there are found very few places which admit not of some *Variation*: yet because it may be profitable to such, who haue not the Command alwayes of the *Sunne*, or sight of the *Starres*, I will insert this *Theoreme*.

I The Line wherein the Directory needle is directed from North to South, is the Meridian for the place.

This may be shewed in any Marriners *Compass*, or little *Sunne-Dyall*, whose needle is magnetically touched. For being set euently parallel to the plaine of the Horizon, it wil shew by the needle, the Meridian for that place in euery vertical point on the earth. For example in the *Sea-Compass* in the next page, experience will witnesse in euery Region of the Earth, that the one point signed out by the *Lilly*, will alwayes turne to the *North*; the other opposite part, will turne it selfe, to the South; which two parts being ioyned together by a right Line will shew the Meridian for that place: The Meridian (I say) not alwayes the true; for this Inuention taken from the *Magnet* is not so exact as the Astronomicall; for as much as few or no places are found, wherein the *Magneticall Needle* admits not a *Variation* from the true points of *North* and *South*: Neuerthelesse, this way is very necessary to be known: for as much as the *Sunne* and *Starres* are not alwayes to be seene; at least in such place and manner as may fauour exactnesse of obseruation: Hence may be demonstrated in particular,



lars, what we obserue before in generall in our *Magneticall* Treatise that the *Circles* of the Globe are not meere *Imaginary Fictions*, or bare Reflexes, growing out of the Application of *Celestiall* bodies (as some haue thought them) but grounded on the *Magneticall* Disposition of the *Terrestriall* Globe.

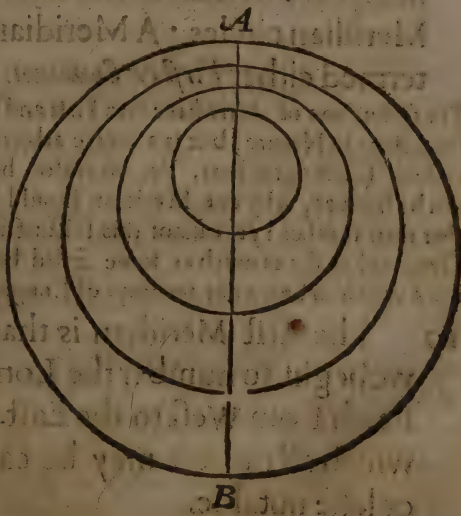
8 Beside the *Astronomicall* and *Magneticall* Invention of the Meridian, there is another way more popular, but lesse exact, which is without any obseruation of the Heauens, or the Magnets operation.

Of the Invention of the Meridian circle, the true and exact knowledge,

knowledge (as we haue shewed) is enebted to heavenly obseruation, or Magneticall experiment. Neuerthelesse, Nature is not so barren, but she hath pointed out to an industrious obseruation, some marks and foote-steps in other inferiour bodies, for the finding out of this profitable circle. Which wayes, howsoeuer of lesse *Account* then the other, and therefore of lesse vse, are notwithstanding pleasant to vnderstand: because nothing delights more an ingenious minde, then the contemplation of Gods working, in and by his creatures, which men vsually terme *Nature*. To make a particular search into all Plants, Stones, Mettals, and other such Bodies, were to goe too farre out of my way, without a Guide. I will giue one onely Instance of Trees, whereof I will insert this Probleme.

I *By the Incision of a Tree, to finde out the Meridian.*

To performe this Probleme, let there be chosen out some Tree in an open free field, farre from walles or other obstacles; in such a place as it hath beene on either side freely enlightened and heated by the Sunne-beams: let the Trunk of this Tree bee very right and sound: let this Trunke be cut off by the middle, in such sort that the section be Parallel to the Horizon, and the vnder-part of the Trunke bee left to stand in his former Naturall situation: Now the Section on the top of it being well plained,



will as in a plaine discover diuers circles, which are *Excentricke* and not drawne from the same Center, but on the one side neerer together; on the other further off: That part then which shewes the circles thicker and neerer together, points out the North: The other wherein the circles are wider and further off, the one from the other, designes out the South-point: betwixt both which if a right line be drawne, it will be the *Meridian* for that place. Which experiment *Blancanus* (as hee writes) tryed in a *Plume-Tree*, but giues no reason for it. The cause I take to be no other then the extension and diffusion of the sappe or moisture, by the heate of the *Sunne*: which is more on the *South-side* then the *North-side*: for as much, as the *Sunne* in our clime respects vs on the South, neuer on the North. Hence is it, that the circles which are nothing else but the excreescences of the moisture, being more rarefied on the *South-side*, and therefore requiring a greater place, are found to be greater.

- 9 Having shewed the *Inuention*, we are in the next place to treat of the *Distinction* of these Meridian circles: A Meridian therefore is termed either *First* or *Common*.

The distinction of *Meridians* into First and Common, hath no foot-steps in Nature, but is a meere arbitrary Imposition of antient Cosinographers. For no reason besides *Conueniency* can be shewen, why one Meridian should be called *First* rather then another: yet cannot this Distinction be wanting to a Geographer, for as much as some seled bound must be set, from which to begin our accompt of Longitudes.

- 10 The first Meridian is that from which we begin to number the Longitude of the Earth, from West to the East. In respect of which all the rest may be called common or lesse notable.

The ancient Cosmographers, amongst whom *Ptolomy* was, the chiefe, haue set the first Meridian in the *Fortunate* Ilands, from whence they began their accompt, passing Eastward through *Europe* and *Africa*, and so through *Asia*, to the vttermost parts of *India*, vntill they returned againe to the first Meridian, passing through the *Fortunate* Islands; Some haue doubted whether these Ilands called by *Ptolomy* the *Fortunate* Ilands, be the same with the *Canaries*; because (as our Countrey man M^r. *Hues* hath obserued) the Latitude giuen by *Ptolomy* to the *Fortunate* Ilands, agrees not exactly to the *Canaries*; but rather to the Ilands of *Cape-Verde*. Notwithstanding this obseruation, I rather sticke to the common opinion, thinking it no vnlike matter, that *Ptolomy* dwelling farre Eastward, and trusting to other mens obseruations, should erre in this, as well as other maters. The reason why the first Meridian should be placed here, rather then elsewhere, is thought by some to be; because the Ancient's supposed two *Magnets*: all Poles in the Earth, which should be the cause of the *Variation* of the Compass. Now because in the *Canary* Ilands, was found no *Variation* at all, they thought it to be the place where the *Magneticall* and the true Meridian should concur, as wherein were both the Poles, of the *World*, and of the *Load-stone*: which made them to make it the first Meridian: But this reason I take to be vnlikely; because as I finde it obserued by latter Writers, in the *Canary* Ilands themselves there is found a *Variation* of the Compass, although very little: the reason whereof wee haue shewed to be because it is the middest betwixt two great Continents, to wit, the one of *Europe* and *Africa*, the other of *America*. Whose magneticall temper being almost æquall, will not suffer the magneticall *Needle* to moue more one way then another? Moreover, I am certainly perswaded (as farre as I can gather) that this placing of the *First Meridian* was appointed here before any certainty was knowne of the *Variation* of the Compass. The more probable coniecture therefore is that *Ptolomy* here placed the *First Meridian*, because it was the vttermost verge of land toward the West, then discovered, neuer dreaming of a Western world afterward detected.

detected and brought to light by *Christopher Calumbus* and *Americus Vesputius*. Some of the latter *Geographers* struiuing to be more exact, haue placed the *First Meridian* in their Mappes out of the *Canaries* in the Ilands of the *Azores* called *S. Michaels* Iland. So that the first Meridian of *Ptolomy* differs from the place of these latter *Cosmographers* about 9 degrees: which is diligently to be noted of such as beginne the Science; because this variety not perceiued, will breed great errour and confusion: yet is not the first of *Ptolomy* out of vse, but retained of many good *Geographers*. Euery other *Meridian* in respect of this, may be called *Common*, or lesse notable, because this is most remarkeable: yet may the rest compared amongst themselves be ranged in a certaine order, as the *Second, Third, Fourth, Fifth*, and so along till we come againe to the *First*, being in all reduced to the number of 180, answering to 360 Degrees as we haue taught. So much for the *Meridians*.

II The Parallels are æquidistant Circles passing from the East to the West directly.

I haue defined the *Parallel* Circles in a larger sense then former *Geographers* vsually haue taken it in: as willing vnder this general name, not onely to include the Parallels commonly so called, but also the *Æquatour*: because I see no reason why the *Æquatour* being euery where æquidistant from each other Circle, should not suffer this acception. The common sort of *Cosmographers*, vnder this name, would onely comprize the minor Circles, which are conceiued to be æqually distant and correspondent to the *Æquinoctiall* Circle, so that all should be so called in respect of the *Æquatour*, to whom they are said to answer, not in *site* and *position*; for as much as they decline from the middle of the Earth to the North and South: but in *Comparison* and *Proportion*; for as the *Æquatour* is drawne from East to West, and diuides the whole Spheare of the Earth into the North and South Hemispheres: So the other also diuide the Globe of the Earth, though not into two equal parts as the *Æquatour*, but vnequall. These

Parallels

Parallels many wayes are distinguished from the *Meridians*: first, because the *Meridians* are drawne directly from North to South: but the *Parallels* from East to West. Secondly, the *Meridians*, how many soever they are imagined to be, concurre and meete all in the *Poles* of the *Earth*: whereas the *Parallels* howsoever drawne out at length, will neuer concurre or meete in any point. Whence it must needs follow that all *Parallels* and *Meridians* in the *Globe* must cut one the other, and make right angles. These *Parallels* although infinite in number, may be in the *Sphere* reduced to the number of the *Meridians*, because they are drawne through the opposite points and degrees of the *Meridian Semi-circle*, which would make vp the number of 180: but yet for *Conueniency* they haue not painted so many in the face of the *Artificiall Sphere*; for as much as so many lines and circles might beget Confusion. Wherefore *Protony* and the Ancients haue distinguished the *Parallels* on both sides the *Aequator*, North and South, with such a Distance, that where the day should increase one quarter of an houre, a new *Parallell* should be placed. So that the longest day of one *Parallell* should surpasse the longest day of another, for one quarter of an houre. By which appeares that the *Parallels* are not of one greatnesse, but by how much nearer the Pole they are placed; so much lesse are they; and so much greater by how much farther off from the *Poles*, and nearest the *Aequator*. These Circles are of great vse in *Geographie*, as to distinguish the *Zone*, *Climats*, and *Latitudes* of *Regions*, to shew the *Elevation* of the Pole, and to designe out the length and shortnesse of the day in any part of the *Earth*.

12 A *Parallell Circle* is of two sorts; either greater or lesser: The greater is the *AEquatour* or *æquinoctiall Circle*.

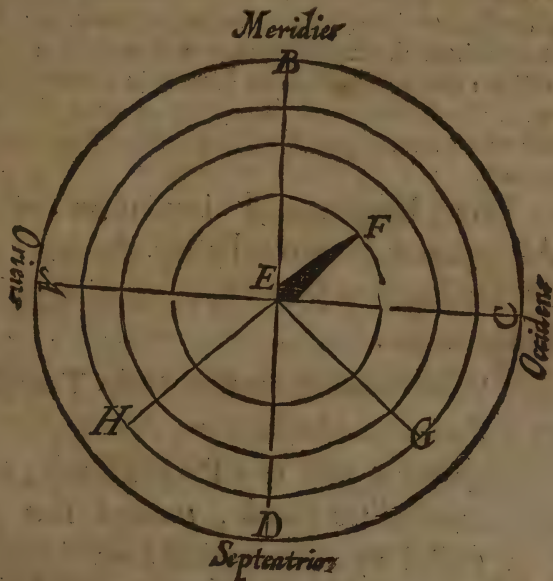
13 The *AEquatour* is the greatest of the *Parallels*, passing through the middest of the *Earth*, and exactly diuiding them from the *Poles*.

Poles into two equall halves or Hemispheres whereof the one is North, the other South.

This Circle is called the *Aequatour* or *Aequinoctiall* of Astronomers; because, that when the Sunne passeth vnder it, as vpon the 11 of *March*, and the 13 of *September*, it makes the Day and Night æquall. This Circle of Astronomers is esteemed the most notable, being the measure of the *Diurnall* and most regular Motions. The *Latines* haue taken the name and appellation of this Circle from the Day, as the *Greekes* from the Night: Wherein the Sense is no way varied; because the equality of the Day argues the like equality of the Night. The two Poles of the Circle, are the same with the Poles of the Vniuersall Earth: to wit, the *Articke* or North-Pole, and the *Antarticke* and Southerne Pole: whereof the former is alwayes conspicuous in our Horizon, the other lies couched and hidde from our Sight. It is called the *Articke-Pole* from the Constellation of the little *Beare* in the Heauens, neere to the which it is situated: in opposition to the which the other is called *Antarticke*. It hath manifold vse in Astronomy, copiously described by *Astronomers*: And no lesse in *Geographie*: for without this *Aequinoctiall* Circle, no Description of the Earth can be absolute and perfect, neither any Citie or Place. in the Terrestriall Globe or Mappe set in his due and proper place. This *Aequinoctiall* Circle in regard of the Earth, passeth through the middle-most part almost of *Africa*, by *Ethiopia*, *America*, and *Taprobana*: So that it exactly diuideth the Globe of the Earth into two halves, the *Northerne* and *Southerne* Hemispheres; so that these people which dwell vnder the *Aequatour* are said to inhabite the middle of the world, because they incline neither to the North, nor to the South: hauing so much distance from the *Articke* as from the *Antarticke-Pole* of the Earth. Moreouer, by this Circle (as we will declare hereafter) are noted, out vnto vs the East and West part of the Spheare, no way to be neglected of *Geographers*.

I Concerning the AEquatour, two things are to be obserued: either the *Inuention*, or the *Site and Position*: The *Inuention* is either *Astronomicall* or *Magneticall*. The *Astronomicall* according to these Rules.

I The Meridian being found out, to find the AEquatour.



This is easily performed by the helpe of the former Figures: for therein the Meridian line being found out (as wee haue shewed) let there be drawne by the Center *E* of that Circle, the line *AC*, making right Angles with the said *Meridian*: which line *AC* will be the true AEquatour, and will point out vnto vs the true *East* and *West*: as *A* the *East* and *C* the *West*. Whence it appeares that the two lines, to wit, of the *Aequa-*

your and the Meridian doe diuide and cut the whole Horizon into two equall Quadrants.

2 *Without the helpe of the Meridian to finde out the AEquatour.*

In the time of either Equinoctiall in some Horizontall plaine, in the open Sun-shine, let there be erected a Gnomon: then in the day time, let there be noted all the points by which the end or top of the shadow hath passed: for all those points in the time of Equinoctiall, are in a right line; because then the end of the shadow is carried in a line in the time of the Equinox in a Horizontall plaine: This line will be the true Equinoctiall-line: the cause is given by *Clavius* in *Gnomonicis*. lib. 1. *prop.* 1. *Corollar.* 2. which depending on many Geometricall and Astronomicall principles, as too farre from my purpose, I omit.

15 The Magneticall inuention of the AEquatour, is wrought by the Magneticall Inclinary Needle, according to this Proposition.

1 *Wheresoever at any place of the Terrestriall Spheare, the Inclinary Needle shall conforme it selfe in a Parallell-wise, to the Axell of the Earth, through that place passeth the AEquinoctiall Line.*

As to finde out the Meridian of any place, we are to vse the helpe of the Directory Needle: so to the finding out of the Equatour, and Parallels, the Inclinary Needle is most necessary: because the former respects the Magneticall Motion of Direction, the latter of Declination: Now wheresoever wee shall see the Needle to conforme it self in such sort as it may lie Parallel with the Axell of the Earth, we may assure our selues, that such a place is vnder the Equinoctiall Circle: The reason whereof

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tory Needles, lying Parallel, to the Axell of the Earth, A.B. will expresse this *Æquinoctiall* line which we heere seeke. For the Magneticall *Inclinary* Needle being set in a Frame or Ring made for such a purpose, will vnder the *Equator* respect one Pole no more then another: but lie leuell with the Plaine of the Horizon: as vnder the Poles it will make right Angles with the Plaine of the Horizon. In the middle spaces betwixt the *Equatour* and the Poles, it will conforme it selfe in such sort, as it makes certaine Angles with the Axell of the Earth, though not æquall, yet proportionall to the Latitude; out of which an ingenious Artificer may deduce the Parallels of any place, without any obseruations of the Heauens: as is taught by Instruments inuented by *Gilbert, Ridley*, and diuers others which haue vndertaken this subiect.

16 Of the *Invention* of the *Æquatour* wee
haue spoken: In the *site* we ought to con-
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sider the placing of the AEquatour in respect of the world.

I *The AEquatour is an vnmoueable Circle, whose Poles neuer vary from the fixt Poles of the world.*

Whether the Poles of the AEquatour haue bin any times varied from the Poles of the world is a controversie which hath exercised the greatest wits : *Ioseph Scaliger* trusting (as it seemes) more to ancient History then Moderne experiment, seemes in two Epistles not only to make a doubt, whether the Poles of the AEquatour haue continued the same with the Poles of the world; but superciliously (as the manner of most criticks is) rather out of *coniecture* then *Reason*, to taxe the common opinion of manifest error and absurdity. The ground and originall of this doubt growes out of the obseruation of the fixt Starres, which haue since the Times of the Ancients, bin found to be moued out of their places, or at least not to retain the same points in the Periode of the *Sunnes* Motion. The chiefeest Instances are taken from the starres in the Hornes of *Aries*, which in *Hyparchus* time, which liued about 60 yeares before *Ptolomy*, were obserued to be not much distant from the *Aequinoxe*, and before him in the very point it selfe; but in our time remoued about 28 Degrees off : Also it is obserued in the Cynosure or Polar starre, that in *Hyparchus* time it was distant from the Pole about 12 Degrees, which we finde in our time to be scarce 3 Degrees distant. To salue this Apparence, *Ptolomy* invented a slow motion of the Starry Heauen or *Firmament*, whereby the Fixt starres might bee remoued farther off from the *Aequinoctiall* points in the *Eclipticke*, whence of a consequence the *Pole-starre* should not keep the same position in respect of the *Pole* it selfe, but vary his site according to the Motion : which opinion hath a long time passed without contradiction; till *Copernicus* out of new grounds sought for this Motion in the Earth, to which he assigned no lesse then three Motions. Since *Copernicus*, arose *Ioseph Scaliger*, who

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contradicting the common receiued grounds, and yet for ought I see, not trusting to the suppositions of *Copernicus*, would bring in another opinion: to wit, that the *Starres* of the Firmament are not moued from the point of the *Aequinoxe*, but rather that the point is carried away from the *starres*. The decision of this point I dare not undertake, better becomming the learned and industrious endeauours of our worthy Professours, M. Doctour *Bainbrigg*, and M. *Henry Briggs*, as best suiting with their Learning and Profession: *Ipse semipaganus, ad sacra vatum carmen offero nostrum*. Neuerthelesse as a Learner, for mine owne satisfaction, I would willingly enter a little into conference with this great and admired Oracle *Ioseph Scaliger*, to sound the certainty of his grounds. That the *Pole-starre* (saith he) was so farre distant from the Pole as 12 Degrees, was no true obseruation, but the error of *Hyparchus*, who afterwards by his authority deceived *Ptolomy*; and He, Posterity. The Reasons he alleaged are, 1 Because *Endoxus* which was more ancient then *Hyparchus*, obserued the same starre to be in no other place, then where now it is. 2 Because that greater light of Astronomy, *Copernicus* perceiuing the *Aequinoxes* and *Solstitial* points to bee moued, was enforced to invent other grounds: but because his demonstrations depended only on the *Apparances*, he sought out this effect in the motion of the Earth. If it were manners to oppose so great a Scholler as *Ioseph Scaliger*, I would aske a few questions, why we should not credit the obseruations of *Hyparchus*, *Ptolomy*, and all posterity, as well as of *Endoxus*: sith Antiquity without consent and approbation, is no great argument of truth. Neuerthelesse if the matter bee well examined, we shall perhappes find Antiquity to be more firme on our side. The same reason (as I take it) may be giuen for the *starres* in the Hornes of *Aries*, as of the *Pole-starre*, because all the *fixt-starres*, by the consent of all, are imagined to keep the same vniforme site among themselves in such sort, as the varving of some, would disorder all the rest: at least argue the like variety or change of all. Now to proue the *starres* of *Aries* to haue bin varied, many of the Ancients (as Master *Hues* hath obserued) living in diuers times, haue confirmed.

The first starre of *Aries*, which in the time of *Meto Atticus*, was obserued in the *Vernall Interfection*, in the time of *Thales Milesius* was before it 2 Degrees; in *Tymocharis* age it was after it 2 Degrees 24 Minutes: In *Hipparchus* time 4 Degrees, 40 Minutes; in *Abbumazars* 17 Degrees, 50 Minutes; in *Albarens* 18 Degrees, 10 Minutes; in *Arzachels* 19 Deg. 37 Min. in *Alphonfus* his time 23 Deg. 48 Min. In the time of *Copernicus*, and *Rheticus*, 27 Degrees, 21 Min. In our time about 28. Against all these Testimonies, if we should oppose the Testimony of *Eudoxus* and *Scaliger*, we should be thought very partiall to preferre them before the consent of Antiquity: *Eudoxus* though very *Antient*, being but one, and the other one of the last. If any should obiect, that *Eudoxus* spake onely of the *Pole-starre*, and not of the starres in the hornes of *Aries*; I answer, (as before, that the same reason is to be giuen of them both; For as much, as if the *Pole-starre* in *Eudoxus* time moued in a Parallell, Æquidistant from the *Pole* of the *Æquatour* (which he seems to contend) then must also the stars of *Aries*, which were found once to be in the point of the vernall Æquinoxe, moue alwayes in the Æquinoctiall circle, and neuer vary from it; which is contrary to all the Testimonies before alleadged. Secondly, where he saith, that *Copernicus* perceiuing this error, left a bare discouery, without any *Demonstration*, except onely *Εκ τῶν φαινομένων*, I would know how *Ioseph Scaliger* by any other meanes came to know it? I alwayes supposed it a principle amongst *Mathematicians*, that the *τὸ φαινόμενον* had bin the surest ground of Mathematicall *Demonstration*: for euery reason which can be alleadged, must of necessity be grounded on meere coniecture, as forged in a mans braine without any obseruation of Nature; or else suggested vnto vs from the things themselues. How little dependency is on the *Former*, let euery man iudge: where it is as easie for euery man to deny, as affirme; and such fancies are better reserued in the braine, wherein they were first hatched, then bee suffered to proceed further. If we deriue our Argument (as we ought to doe) from the footestepes of Nature; we must draw it either from the *Forme* it selfe, or from some *effect* or propriety arising from it: The former is vnpossible. I may well say in any thing,

thing; because the first forme & nature, no waies discouers it self to our vnderstanding, but by the apparent Accidents : much lesse can this be hoped for in the Heauens, being as farre distant from vs in space, as Nature. If then we are left only to the later, what other ground can we haue of our Argumentation, then the *re quæritur* or Apparences: which kind of way, *Scaliger* in *Copernicus* striues to sleight or reiect as weake or deficient: taking then this to be the only way to search as neare as we can into the truth of their matters, we will in the third place shew how farre it may oppose *Scaliger*, and fauour our Assertion. That the first starre of *Aries* is more distant from the Equinoctiall point, is a matter which seemes to be agreed on by all sides. This Apparence must necessarily arise out of some Motion. This Motion must be sought either in the *Earth* (as *Copernicus* would haue:) or it in the *heauens*. That it cannot with any great probability be in the *Earth*, we haue shewed in the third Chapter, where we haue proued it to haue a Magneticall verticity, whereby it continually respects the same *Poles*. The Arguments (I confesse) are only probable: but this is an opinion which *Scaliger* defendeth not. If we seeke this effect in the Heauens, it must of necessity (which *Scaliger* confesseth) happen one of these 2 wayes: For either the stars standing vnmoueable, the Equinoctiall & Solstitiall points must be moued, or els the stars theselues should moue, as *Ptol.* defends. Here I cannot but remember a merry answer of that great *Atlas* of Arts, Sir *Henry Saule* in the like question. Being once invited vnto his Table, and hauing entred into some familiar discourses concerning *Astronomicall* suppositions: I asked him what he thought of the *Hypothesis* of *Copernicus*, who held the *Sunne* to stand fixe, and the *Earth* to be subiect to a *Triple* Motion: His answer was; he cared not which were true, so the Apparences were solved, and the accompt exact: sith each way either the old of *Ptolomy*, or the new of *Copernicus*, would indifferently serue an *Astronomer*: Is it not all one (saith he) sitting at Dinner, whether my Table be brought to me, or I goe to my Table, so I eat my meat? Such an answer would aswell besit this question: whether the first starre of *Aries* should be moued from the Equinoctiall

quinotiall point, or the point from it, 'tis a matter should little trouble a *Cosmographer*;; so either way might indifferently serue to salue the apparent ob'seruatiōs: But how *Scaliger* upon this granted suppositiō, would make all whole, without disturbing the order and forme of Nature in the cœlestiall Machine? what Regular motion he would giue the Sunne, whose period describes the *Equinoctiall points*, which he makes moueable? what other *Poles* he would assigne to the world besides that of the *Æquator*? is a matter of a more curious search, and besides the limits of my subiect: The full discussion of which points, as most of the rest: *Illis relinquo quorum imagines lambunt--- Hedera sequaces.*

17 The *lesser* Parallels are æquidistant lines answering to the *Æquator*, which diuide the Globe of the Earth into two vnæquall parts.

18 These *lesser* Farallels are againe of two sorts: either *Named* or *Namelesse*; *Named* are such as are called by speciall names, and haue more speciall vse in *Geographie*; such as are the two *Tropicks*, and. the two *Polar* circles.

19 The *Tropicks* are Parallels bounding the Sunnes greatest declination, which is either to the North, and is called the *Tropicke of Cancer*: or towards the South, and is called the *Tropicke of Capricorne*.

The *Tropicks* haue taken their names from the conuersion or turning back of the Sunne; because the Sunne declining frō the *Equinoctiall* circle either North or South, proceedeth in his course no further then this circle, and so turneth backe: so
that

that in the heauens they are as limits and bounds, comprehending within them that space, without the which the Sunne neuer moues: Consonant to these *Cælestiall Tropicks*, are there imagined in the earth the like, immediately placed vnder them: which are apparent, not onely by *Application* of the *Cælestiall Globe*, and his parts to the *Terrestriall*; but also out of the *Magneticall* disposition of the earth, as we haue already shewed: The Tropicke bounding the Suns greatest declination towards the North, is called the Tropicke of *Cancer*; because the Sunne arriuing at the Tropicke, is lodged in the signe of *Cancer*: The other is termed the Tropicke of *Capricorne*; because the Sunne touching that Tropicke, is in that signe: The distance of these Tropicke, from the *Equatour*, is ordinarily put 23. Degrees, and 30 Minutes; which is also the distance of the Poles of the *Eclipticke*, from the Poles of the world. The Tropicke of *Cancer*, as it is conceiued in the Earth; passeth by the greater *Asia*, by the *Red-Sea*, or *Sinus Arabicus*, and *China*, and *India*: But the Tropicke of *Capricorne*, situate on the Southerne side, runneth along by the most Southerne coast of *Africke*, and that part of *America* which is called *Brasil*; Besides many Ilands in the *Indian Sea*.

20 The Polar circles are Parallels answering to the Polar circles of the Heauens, drawne by the Poles of the *Eclipticke*: These are of two sorts; either the *Articke* compassing round the North Pole; or the *Antarticke* compassing round the *Antarticke* or South Pole.

The Polar Circles, as they are conceiued in the heauens by *Astronomers*, are described by the Poles of the *Eclipticke*, carried by the diurnall motion about the Poles of the world. Correspondent to these circles in the heauens are imagined two circles on the earth, which we also call Polar; and if wee

believe *Gilbert*; with other Magneticall Philosophers; they are primarily in the Earth, as that which is the true subiect of diurnall motion. These circles thus described by the Pole of the Eclipticke, must needs challenge the same distance from the Pole, which the Pole of the Eclipticke hath, to wit, 23. Degrees, and 30 Minutes. The *Greekes* haue taken the Polar circles, in another sense then the *Latines*: for by these Polar circles (as it appeares by *Proclus*, and *Cleomedes*) they vnderstand not such circles as are described by the Pole of the *Zodiacke*; but two other circles; whereof the one is greatest of all the Parallels, which alwayes appeares aboue our Horizon; the other is the greatest of all those Parallels which lie hid in our Horizon perpetually: The reason why the *Gracians* tooke it in this sense, was; because by these circles they could know and distinguish those starres, which alwayes are seene and neuer set, as those which are comprehended of the *Articke* circle; from those which alwaies lie hidde and neuer rise; as such as the *Antarticke* containes: Whence it manifestly appeares, that the two Polar circles, as they are taken of the *Gracians* in all Regions, are not of the same quantity and greatness, but are greater in an oblique Spheare then in a right: but our Polar circles are at all places alike in their quantity. Of these, the one tearmed *Articke* in the Earth passeth by *Islandia*, the top of *Norway* and *Finland*, with many adioyning Ilands, and the Southerne part of *Groen-land*, as may appeare by our ordinary Geographickall Mappes. The other Polar circle called *Antarticke*, passeth through the South part of the world (as yet) vndiscovered, except for some few parcels, as *Terra del Fuego*, and *Psitacorum Regio*, with some-what more, lately discovered by the *Spaniards*. The chiefe use as well of these, as other Parallels, is to distinguish the *Zones* and *Climates* in the Globe, whereof we shall haue occasion to treat hereafter.

21 The Namelesse Parallels are such as are not knowne by speciall Names, nor of so great vse in Geography.

These

These namelesse Parallels may be well vnderstood by that which we haue aboue spoken: for howsoeuer they be not called by particular and special names, yet are they all of the same nature: All these Parallels beside the Equatour, though infinite in number, may notwithstanding in the speare be reduced to the number of the Meridians; because they are drawne through the opposite points of the Meridian semicircle; so that we might account 180; but yet there are, not so many painted on the face of the *Artificiall* Globe; wherefore *Ptolemy* with the ancients, haue distinguished the Parallels on both sides, North and South, beginning from the Equatour at such such a distance, that where the day should increase one quarter of an houre, a new Parallell should be placed: so that the longest day of one Parallell, should exceed the longest day of another Parallell by one quarter of an houre. Euery one of these Parallels, is supposed to be diuided into 360 Degrees, as all the rest of the other circles; yet are wee to note that the degrees and parts of a greater circle, are greater; of the lesser, lesse, according to the proportion of the said circle; so that the same proportion that a great circle hath to a lesse, the same haue the degrees and parts of a quarter circle, to the degrees and parts of the lesser; as may be gathered from the first proposition of the second booke of *Theodosius*: now to know rightly this proportion, we must first finde out the summary declination for euery region, which being once found, we may proceed in this manner, by the doctrine of Triangles.

1. *Let the sine of the Complement of the Declination of the lesser Circle be multiplied by the whole Circle, and the product be diuided by the totall sine, there will arise the number of Degrees of the lesser Circle, such as whereof the greater consists.*

The reason hereof is shewed in Geometry, and therefore need we not to insert a demonstration; for there we learne, that

as the totall sine is to the sine of the Complement of the Declination of any Parallell, so is the Periphery of the greater circle, to the Periphery of the Parallell: As for example, if wee would know what proportion the Æquatour hath to the Parallell, which passeth by the Verticall point of *Rome*; whose Declination is about 42 Degrees; I multiply the sine of the Complement of this Declination, that is, the sine of 48 Degrees; to wit, 74314, by 360; the product whereof is, 26753040; which I diuide againe by 100000, and find 267 degrees, and $\frac{1}{2}$: whence I gather that the Æquatour to the Parallell of *Rome*, or a degree of the Æquatour, to a degree of the Parallell of *Rome*, hath the same proportion that that 360 hath to 276 $\frac{1}{2}$; which is the same that 4 hath to 3.

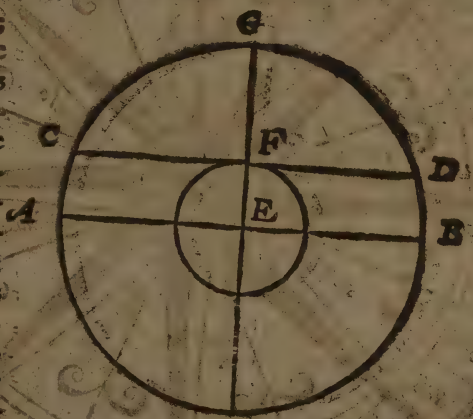
22 Hitherto haue we spoken of the *Absolute* Circles, such as are the Meridians and Parallels: we are to treat in the last place of a *Relative* Circle, which is conceived in respect to our sight: this Circle is called the *Horizon*.

23 The Horizon is a Circle which diuides the vpper and visible parts of the Terrestrial Globe, from the lower and visible.

The name of the Horizon is taken from the bounding or termination of the sight; because it is a Circle comprehending all that space which is visible of vs, distinguishing it from the rest which lurkes invisible: as if a man should be placed in a high and eminent place of the Earth, and should looke round about him euery way to the *East, West, North, and South*; Hee will seeme to see the heauens on euery side to concur with the earth: so that beyond it, can be seene nor heauen nor earth: which concurrence of the heauens with the earth, will describe vnto vs the *Horizontall* Circle for that place assigned. But

heere

heere we are to note, that the Horizon is two-fold; either the *Rationall* or *Sensible* Horizon. The *Rationall* precisely diuides the Globe into two æquall parts: But the *sensible* or *apparent* Horizon, is no other then that Circle in the earth, which is designed out by the sight, from which the name seemes to be deriued. This *sensible* Horizon differs from the *rationall* diuers wayes; first, because the *rationall* diuides the whole spheare into two æquall parts; but the *sensible* into two vnæquall parts. Secondly, because the *rationall* is alwayes certaine and the same, in the same place, and of alike greatnesse; whereas the other is greater or lesser, for the condition of the place or sight; for the semidiameter of the *rationall*, is the same with the semidiameter of the earth; but the semidiameter of the other, seldome or neuer exceeds 60 miles on the Earth: Thirdly, because the *rationall* Horizon passeth by the Center of the Earth; whereas the *sensible* toucheth onely the surface of it, in that point where the Inhabitant standeth: all which differences may be true in this Figure; wherein the Line C D, represents vnto vs the *sensible* Horizon: the Line A B the *rationall*: The former is called *Natural* or *Physical*; because it comes vnder the measure & apprehension of the sense: the other *Astronomical*, because it is of great vse in Astronomy: in the resolution of the Horizon into his parts, we ought to consider two things: first, the Poles of the Horizon; Secondly, his *Periphery*, or circumference: The Poles are commonly called *Zenith* or *Nadir*: The



Zenith is the *Verticall* point, directly placed ouer our Head: whereunto is opposite on the other side, the *Nadir* directly vnder our foote, and therefore may be called the *Pedall* point. The parts or interfections in the circumferences, are designed out vnto vs, by certaine lines, discovering the coasts in the Terrestrial Globe: These lines are called either *windes* or *Rhumbes*: The windes with the *Gracians* were onely 8. But the latter Navigators haue increased them to the number of 32, whereof foure were called *Cardinall*; to wit, such as are directed to the foure coastes of *East*, *West*, *North*, and *South*: The other are *Collateral*, being placed on each side of the *Cardinall* windes. The *Rhumbes* are Lines passing by the *Verti-*



call point of any place, as you may see in the *Compass*; going before: Now because the *Rhumbe* answeres to two coasts or windes; the number of the *Rhumbes* is but halfe the number of the windes; to wit, 16. Here it is to be noted, that a *Rhumbe* differs from a *Winde*; whereas a *Rhumbe* is one line, pointing out vnto vs, two windes or coasts: These *Rhumbes* as they are conceiued in the *Globe*, were thought by *Nonnus* to be the portions of greater *Circles*: But learned *Mr. Hues* in his booke, out of vndoubted principles, strongly confutes him. The groundes which he takes are these: First, that all *Meridians* of all places passe the *Pole*, and cut the *Equatour* and all his *Parallels* at right Angles. Secondly, If our course should be directly any way else, then towards one of the *Poles*, a new *Meridian* must succeed, and a new *Horizon*. Thirdly, that the *Iron Needle* being touched with the *Load-stone*, shewes the common section of the *Meridian* and the *Horizon*, and on one side perpetually respects the *North*, on the other the *South*. Fourthly, the same *Rhumbe* cuts all the *Meridians* at all places at equall Angles, and euery where respects the like coasts in the world. Fifthly, that a greater circle drawne by the *Verticall* points (if remoued from the *Equatour*) cannot cut diuers *Meridians* at equall Angles. Sixtly, a greater circle drawne by the *Verticall* point of any place, makes greater Angles with all other *Meridians* then with that, from which it was first drawne: whence it is necessary, that the line which shall be supposed to make Angles with diuers *Meridians* (as the *Rhumbes*) should be bowed toward the *Meridian*. I know not what would be more said against the opinion of *P. Nonnus*, who would haue all the *Rhumbes* to be portions of greater circles. To illustrate further the nature and vse of the *Horizon* we will insert these *Theoremes*.

2. The Sensible and Rationall Horizon in the Earth, are much different; in respect of the Firmament, all one.

Ptol. dist. 1.

cap. 5.

Alph. 6. diff. 6.

Prop. 11. lib. 1.

Pag. 149.

It may be gathered out of the suppositions of *Ptolomy* and *Alphraganus*, and almost all other Astronomers, that no man being placed on the surface of the earth can precisely see the halfe of it. For that Horizon which terminates our sight, as wee haue shewed, is a plaine superficies every way circularly extended in the Earth, in such sort as men placed, either in the Sea in a ship, or in a great field or Countrey, would think the visible part of the earth to be plain, whose ends would seeme to touch the Heauens. Whence must needs cometo passe that such an Horizon cannot diuide the Spheare of the earth into two equall parts. For so much will be found wanting, as is measured betwixt that superficies which toucheth the earth, and that which passeth by the Center of it, equidistant from the other; for this later only can diuide the earth into 2 equall parts, according to *Theodosius*, and may well bee seene in the former figure, wherein are expressed both *Horizons*, as wel the visible as invisible, touching the Spheare in a point on the superficies: as the *Rationall* passing by the Center. Neuertheless we must consider, that the quantity intercepted betwixt these two *Horizons* in the Terrestriall Spheare, is of little or no moment, compared with the whole frame of the Heauens: For sith the Heauens are so farre distant from vs, it will come to passe that if two equidistant lines should be drawne, the one from the *Eye*, the other from the Center of the Earth to the *Firmament*, they would according to sense, appeare one and the selfe-same; by reason of the wonderfull distance: as wee see in a long Gallery, whose walls haue an equall distance the one from the other; the walls will notwithstanding (according to *Opticall* principles) seeme widest where they are nearest, and to close and shut vp at the ends, or at least to concurre nearer: much more must we imagine this to happen in the sight, if we compare the greatnesse of the *Firmament* with the Spheare of the Earth, in whose magnitudes wee shall finde an incomparable disparity. This will appeare by the Apparences: for we shall see the fixe figures of the *Zodiacke*, conspicuous aboue our *Horizon*, and the other fixe vnder it, hid from our sight: Also the *Sunne* and *Moone*, when they are diam-

trally

trally opposed, almost at the same moment will appear; the one in the East, the other in the West: at least the one will rise soone vpon the setting of the other: And (if we beleue *Pliny*) the Moone was obserued to be eclipsed in the East point; the Sunne at the same time being in a sort about the Horizon in the West. Such an Eclipse could not happen without a diameterrall opposition of the two lights, and therefore can the Sensible and the Rational Horizon haue no sensible difference in respect of the Firmament.

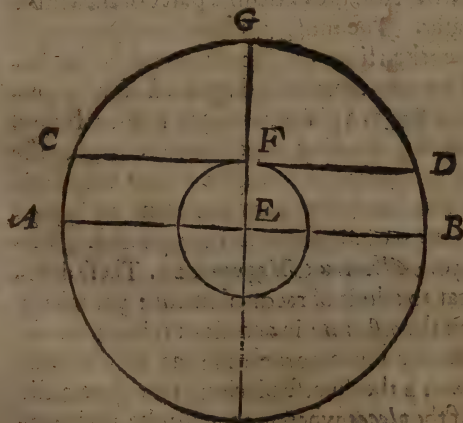
2 *The sensible Horizon may be greater or lesser according to the nature and disposition of the place.*

In this consideration we take no notice of the difference of sights, whether they be weaker or sharper; but suppose an eye sufficient to kenne so farre in the Earth, as the place will permit. The difference then betwixt diuerse Horizons must bee sought out in the condition of the place. A *Sight* placed on the top of a high mountaine, may see much farther then one in a low valley, compassed about with hills; forasmuch as the Semidiameter of the sensible *Horizon*, which is equall to the Rayes or Lines drawne from the extreame parts of the visible Earth, are much greater. The most indifferent iudgement of this *Horizon*, may be taken from the superficies of the Sea beyond sight of land: for a man thereon sayling in a ship, may perceau the surface of the Sea as a plaine, on euery side to bound the sight in a round circle, seeming together to terminate the end of the Earth, and protension of the sight. What the Semidiameter of this Horizon should be, hath not bene yet agreed vpon by all: *Eraſtokenes* would haue it to be 44 miles. *Macrobius* 23. *Proclus* 250. *Albertus Magnus* 125. These differences seeme too great to admit of reconcilement: yet taking into our consideration the disparity in accout of miles betwixt the *Moderne* and *Ancient* Cosmographers; as also betwixt the *Greekes* and *Latines*: 2 the diuerse placing of the sight. 3 the various disposition of the places wherem they tooke their obseruations, with other circumstances, we should diminish much

of admiration. But diuerse others whose opinion is more ap-
 proued by moderne Cosmographers, haue defined it to bee a-
 bout 63 miles. The cause why this Horizon should be so little
 in respect of the Rationall which passeth by the Center, is the
 roundnesse of the earth interposed betwixt the sight & the far-
 ther parts, which we haue formerly proued.

3 *The eye may be so placed on the Earth, as it
 may behold the whole Hemispheare of the hea-
 uens, and yet no part of the Terrestriall spheare.*

This may seeme a paradoxe with vulgar iudgements; but
 it wants not a demonstration drawne from Astronomicall and
 Optick principles. To expaine which, we must suppose out of
 the grounds already granted, 1 That the *sensible* and *Rationall*
Horizon in respect of the Heauens, ought to bee esteemed one
 and the selfe same, by reason of the great distance and dispro-
 portion betwixt the Earth and the Firmament. 2 That the eye
 of the beholder is in this sort supposed to be in the Center; be-
 cause in this consideration the distance betwixt the superficies
 of the Earth, and her Center, is insensible. 3 That the visuall
 Ray wherein the sight is carried, is alwaies a right line. Now



suppose (accord-
 ing to our for-
 mer figure) the
 Center of the eye
 wherein consists
 the sight, to be in
 the point of the
 Terrestriall sur-
 face F, the di-
 stance (as wee
 said) betwixt F
 and E the Center
 being insensible,
 the eye is imagi-
 ned in the center:
 likewise the Ho-
 rizon

rizons CFD, and A E B' for the same cause in respect of the Heavens are to be esteemed one & the same, because CA & DB haue no sensible difference. It is the manifest, that the eye so placed will behold in the heavenly Spheare, all which is included betwixt A & B, to wit, the Hemisphære A G B, bounded by the Rationall Horizon A E B. Neuerthelesse in the Terrene Globe it can see nothing at all: For either it should see only the point F, wherein it is seated, or else some other point or part distant from it: the former cannot be admitted, because the eye being there supposed to be placed, should according to this supposition behold it selfe, which is against Philosophy: For granting the sense only a direct and not a reflexe operation, it cannot be imagined how it should perceauce it selfe. Finally, it cannot see any point in the Earth besides; for then this point would either be placed about the point F: but this cannot be, because F being supposed in the superficies, admits of no point higher in the Spheare, or else vnder it: but this cannot be, because CFD being a tangent line, and touching the Spheare in F only: there cannot according to Geometrical principles be drawne any right line from the point F, which can touch any point in the said Spheare, but all will cut it, and so the section cause impediment to the sight, the Earth being an opacous and round body.

4 *From the Horizontall circle is reckoned the eleuation of the Pole in any place assigned.*

The finding out of the eleuation of the Pole is a matter most necessary for a Cosmographer; as shall appeare after, where we shall speake of the *Latitudes* and *Climates*. It is defined to be an arch of the *Meridian* betwixt the *Horizon* and the Pole. For the finding out of which many waies haue beene deuised by Artificers: The first is taken from the Sunne, the second from the Pole-starre: From the Sun it may be performed two waies. 1 At the time of the *Aequinoxe*. 2 At any other time of the yeare. At the time of the *Aequinox* it may be found out by the obseruation of the Sunnes shadowe at Noone-tide, in this manner: Let the Meridian height of the Sunne be sub-

tracted from the whole quadrant, which is 90 degrees: there will remaine the distance of the Zenith to the Equator, which is equall to the eleuation of the Pole. In the second place at any time of the yeare to knowe the eleuation of the Pole out of the Meridian height of the Sunne, it is necessary out of an *Ephemerides*, or any other way, accurately to finde out the place of the Sunne in his *Eclipticke* for the day proposed, together with his declination: for the declination of the Sunne, the Sunne being in the six Northerne signes, subtracted from the Meridian altitude; or added, the Sunne being in the six Southerne signes, will precisely giue the height of the Equator: or (which is the same) the *Meridian* height of the Sun in the *Equinoctiall*; which being once found, we may worke as in the former. By the Pole-starre we may likewise finde it out, if wee obserue it three distinct times in the same night: for three points being giuen, every Geometrician will finde out the Center, which in this case must be the Pole. Many other waies haue beene inuented by skillfull Astronomers, which appertaining rather to *Astronomy* then *Cosmography*, I purposely omit.

24. Concerning the Horizon, two things are chiefly to be noted, the *Inuention* and the *Distinction*. The *Inuention* is considered either as it concernes the Zenith or Pole, or the Plaine of the Horizon. For both which we will set downe these Rules.

1. The height of the Pole subtracted from the quadrant of 90 Degrees: the residue will shew the Zenith or distance of the Zenith from the Pole.

The reason is evident; because the height of the Pole, together with the distance of the Pole and the Zenith make an arch, which is a whole quadrant: so that the height of the Pole subtracted, the distance will remaine; as for example, if we put the

eleuation

elevation of the Pole here in *Oxford*, to be $51\frac{1}{2}$ degrees or thereabout (as hath beene formerly taught: Let these $51\frac{1}{2}$ degrees be subtracted from 90, then will remain $38\frac{1}{2}$, which is the true Zenith for that place.

- 2 *A line which makes right angles with a plummet perpendicularly falling on it, will designe the Horizontall plaine.*

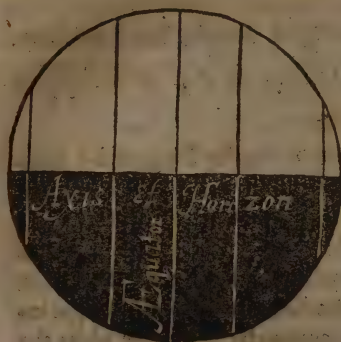
The practise of the proposition is vsually shewed by Artificers by a certaine instrument called a *Levell*, which is made in a triangle forme: from the vertex, or head of which, a line with a plummet falls on the Basis. Now when it shall be found to be so placed, that the line and plummet falling on the Basis, shall make right Angles with it, and cut the whole Triangle into two aequal halves: we may account the Base-line to be the plaine of the Horizon: For of this plaine, such is the position, that it inclines no more on the one side then on the other, but lies euen: as we see in the surface of the water, when it rests quiet without motion: for howsoeuer the water so resting (as we haue formerly demonstrated) is alwaies sphaerickall, yet in a small distance in the sensible Horizon, it may to sense be represented by a plaine.

- 25 So much for the Invention: The Distinction of the Horizon is into three sorts: for either it is a right Horizon, or oblique, or parallell.

- 26 A right Horizon is that which with the AEquator makes Right Angles.

This distinction growes naturally out of the Respect of the Horizon to the AEquator. For sith the AEquator is one and the selfe-same immouable circle; and the Horizon is mutable and changed according to his diuers verticall points, they cannot alwaies keepe the same situation in regard one of the other. This they haue reduced into three heads: for either it is *Right*

or *Oblique*, or *Parallel*. The Right is so called from the right Angles which the Horizon makes with the Equator: wherein the two Poles are alwaies couched in the Horizon, and the Equator



passing directly over their heads, as is plaine to be seen in this figure here affixed: such a Horizon have these Inhabitants which dwell directly vnder the Equinoctial line, in the very middest of the Torrid Zone: such a Horizon agrees to a great part of *Africke*: to a part of *Perru* in *America*: Also to most of the *Molucco* Islands, the

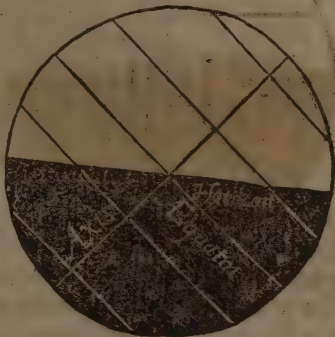
Islands of *Taprobana*, and *S. Thomas*: but no part of *Europe* is subiect to such a Right Horizon. The cause of this variation of Horizons is the naturall roundnesse of the Earth: For the earth being supposed to be sphaericall, as we haue before demonstrated, it must of necessity follow, that the site of the Poles should be changed according to the diuersity of the places. Also, because wheresoeuer wee are placed on the Earth (as wee haue shewed) all impediments of the sight, as mountaines and vallies put apart, we can behold the Hemisphere of the Heauens, which middle part being set downe is diuided from the part vnseene, by the Horizon it must needs be, that either both the Poles must be in the Horizon: and so make a Right Spheare: or at least one must be aboue and seen, and the other hid from the sight, and so much as one is cleuated aboue the Horizon, must the other be couched vnder it. For otherwise wee should see more or lesse then a præcise moiety, or halfe of the Heauens: sith the Poles differ one from the other the halfe of the whole Heauens: to wit, by the Diameter of the world.

27 An oblique Horizon is that which with the Equator makes oblique Angles.

Those Inhabitants are said to haue an oblique Horizon, whose

site

site an position declines somewhat from the Equator, either to the North or South towards either Pole: yet so that the Pole be not eleuated so high as 90 Degrees: for then it becomes a *Parall^l* Horizon, as we shall shew in the next. The representation of such an oblique Spheare may bee seene in this Diagram: wherein the Horizon cuts the Equatour at oblique Angles, whence it is called *oblique*. *Clavius* seemes to adde another reason of this appellation: to wit, because in such an Horizon one Pole is alwaies eleuated aboue, & the other hid: but this reason seemes too generall, as that which agrees not only to an *Oblique*, but also to a *Parall^l* Spheare. From this Horizon, by *Iohannes de Sacrobosco*, the Spheare is called *Artificiall*: because, as *Clavius* coniectures, it is variable, & doth not naturally diuide the Globe. For whereas the Horizon of the Right Spheare passeth by either Pole, it seemes by it selfe (as it were) Naturally and Directly to diuide the Spheare: and this diuision is no way variable, as that it should bee more or lesse Right: but contrariwise in the oblique Spheare, sith one Pole is placed aboue, and the other beneath, it seems to be placed out of his naturall site and position. Moreouer this Oblique Horizon is variable according to the diuersity of habitations, so that it may be to some more, to others lesse Oblique: for so much the more Oblique must it bee, by how much the neerer it is placed to the Poles. The Inhabitants of an Oblique Spheare, are such as are seated betwixt the Equator, and either of the Tropicks of *Cancer* and *Capricorne*, or such as dwell betwixt either Tropick and the Polar circle.



28 A *Parall^l* Horizon is that which lies *Parall^l* to the Equator, making no angles at all with it. Such

Such a kinde of Horizon those Inhabitants are said to haue, which are included betwixt the Poles of the world, and the Polar circles; whose Horizon cuts not the Equatour at any Angles at all, either Right or Oblique: but lies Parallell vnto it, as



we see in this Figure here set downe. Some haue reduced this kinde of Spheare to an Oblique Horizon: in regard that in this site our Pole is elevated aboue the Horizon, and the other depressed vnder: in which opinion *Clauius* seems to second *Iohannes de Sacrobosco*, on whom he comments. But this is ridiculous; because the Sphear

is called *Right* or *Oblique* (as we haue taught) from the Angles which the Horizon makes with the Equator: wherefore that Horizon which makes no Angles at all, cannot bee called either *Right* or *Oblique*, but is necessarily distinguished from either. On this distinction of Horizons is grounded the diuision of the Inhabitants of the Earth according to three kinds of Spheares: of whose accidents and proprieties wee shall more fully treat hereafter in the distinction of the parts and Inhabitants of the Terrestriall Spheare, because such proprieties cannot so well be taught without the knowledge of the *Artificiall Spheare*, whose Nature and Fabricke we shall labour (God willing) in our next Chapter to vnfold.

C H A P. VII.

Of the Artificiall Representation of the Terrestriall Spheare.

HAuing hitherto treated of the Terrestriall Spheare, as it is Naturall or re-

all: we are in the next place to speake of the *Artificiall Globe*: The *Artificiall Globe* is an expression or imitation of the *Spheare* of the *Earth*.

- 2 The *Artificiall* imitation of the *Earth* is either *Common* or *Magneticall*. The common is againe twofold; either in the *Globe*, or in the *Geographicall Mappe*, or *Table*.
- 3 The *Geographicall Globe* is a round solid Bodie, adorned with *Lineaments* and *pictures*, serving for the use of *Geographers*.

Who was the first Inventor of this *Artificiall Globe*, it is not euident: Some thinke with *Pliny*, that it was found out by *Atlas*, and carried into *Greece* by *Hercules*. Others haue ascribed it to *Anaximander Milesius*; some to *Museus*, as *Digenes Laërtius*; others to other Authors, amongst whom *Archimedes Tarentinus* is not forgotten, as one that was esteemed the rarest Mathematician of his time. But all these were out-stripped by *Archimedes* the *Syracusan* Mathematician, who is said to haue composed a *Spheare* of transparent glasse, representing vnto the life the whole frame of the *Heauens*, wherein the *Sun*, *Moon*, and *Starres* with their true motions, periods, and limits were shewed to the sight, in such sort, as if it were naturall: whereof *Claudian* the Poet elegantly wrote in these Verses.

Claudian. in Epigrammat.

*Iupiter in paruo cum cerneret aethera vstro,
Risit, & ad Superos talia dicta dedit:
Hucine mortalis progressa potentia cura?
Iam meus in fragili luditur orbe labor.
Iura poli, rerumq; fidem, legesq; Deorum,
Ecce Syracusius transtulit arte Senex.
Inclusus varijs famulatur spiritus astris,*

S

Ecce

*Et vivum certis motibus urget opus.
 Percurrit proprium mentitus signifer annus,
 Et simulata novo Cynthia mense redit.
 Iamq; suum volvens audax industria mundum,
 Gaudet & humana sidera mente regi.
 Quid falso in fontem tonitru Salmonea miror?
 Emula natura parva reperta manus.*

In a small glasse when *Iove* beheld the Skies,
 He smil'd, and thus vnto the gods replies:
 Could man so farre extend his studious care,
 To mocke my labours in a brittle Spheare?
 Heavens lawes, mans waies, and Natures soueraigne right,
 This Sage of *Syracuse* translates to fight.
 A soule within on various starres attends,
 And moues the quicke-worke vnto certaine ends.
 A faining *Zodiacke* runnes his proper yeare,
 And a false *Cynthia* makes new monthes appeare:
 And now bold Art takes on her to command,
 And rule the Heauenly Starres with humane hand.
 Who can admire *Salmoneas* harmlesse Thunder,
 When a slight hand stirres Nature vp to wonder?

But this Spheare of *Archimedes* I take to be more then an ordinary Globe commonly vsed amongst vs, as may appeare by the Poets description; so that it may rather be likened to the Spheare, lately composed by *Cornelius Trebelius*, and presented vnto *King Iames*. The like whereof *Peter Ramus* sayes he saw two at *Paris*; yet not of glasse, but of Iron; the one of which *Ruellius* the Physician brought from the spoiles of *Sicily*: the other of which *Orontius* the Mathematician recouered likewise from the *Germane* warres. But of such kind of Globes hauing neuer yet had the happines to see any, I intend no description: In the meene time our common Geographicall Globes may well serue our turnes.

4 In the Terrestriall Globe two things are to be considered: 1 The Fabrick or Structure.

2 The

2 The Use. 3 The Direction. In the former is taught the composition of the globe by resolving of it into it's parts.

1 The parts whereof the Globe is Geographically compounded are circles and pictures.

To expaine the true composition of the Artificiall Globe, not Physically as it consists of timber and mettall, but Geographically as it represents the Earth, we are to consider, that the parts of it are either *Externall* or *Internall*: *Externall* I call those parts which are without the Spheare it selfe, yet necessarily concurre to the constitution of it. These parts are such as concurre to the making of the Stock or Frame whereunto our Spheare is set: where to let passe the footing or lower board, (wherein in the old Globes was engrafted a *Marriners Compasse*, with a *Needle magnetically* touched, very profitable for the direction of the Spheare) I will onely speake of the great *Timber Circle*, encompassing round the whole Globe: because it more immediatly concernes our purpose. This Circle represents the *Horizon* of the Naturall Spheare: In the Globe it is made but one, not that there is but one Horizon in the whole Earth; because (as we haue taught) the Horizon is varied according to the places; but because it is impossible to point and marke out the Horizons; for all places being infinite as the Verticall points: yet may this one serue for all places, because the Globe being moueable, may apply all his parts to this circle. This Circle representing the Horizon, is diuided into three borders or Limbes: whereof the first which is towards the Spheare, contains all the *signes* with the *Planets* thereunto belonging; euery of which is diuided into 30 Degrees, which in the Timber Circle are described by set numbers and marks. The second which in the middle-most and longest, contains the Calendar, with the Golden number, and seuerall names of all the Feasts throughout the yeare. The third and last is of the 22 Windes, seruing chiefly for the vse of Marriners, and may serue many waies for a *Geographer* to distinguish the *Coasts* and

points of the Earth. But of these three borders distinguished in the Horizon, only the last hath vse in *Geography*; the other two are in themselves *Astronomicall*, and placed in the *Geographi- call* Globe rather for ornament, then vse. The Internall parts of the Globe are either annexed or inscribed in the face of the Spheare. The Annexed part is that which represents the Meridian, which is a Brasen circle: For as the Externall Frame of the Globe contained the Horizon as one circle; so this Meridian is set but one, although it be in it selfe various, according to the places to which it serue. Neither without good reason is this Circle made of *brasse*, because it should serue for diuerse vses, which require that it should be often changed and turned to and fro, which being of Timber would miscarry. This Brasen Meridian meetes with the Horizon at two opposite places, cutting it at right angles, that the Spheare included might be raised and set lower, as occasion requireth. The Meridian circle is againe diuided into 4 *Quadrants*, each of which is again diuided into 90 *Degrees*; so that on the one side the 90th Degree must touch the Pole; on the other side the first degree; so that in all there will arise 360 degrees, described in the Brasen Meridian. Through this Brasen Meridian by the two Poles doth passe a line or wier, which is called the *Axell-tree* of the Globe, about the which the Spheare is turned, the ends of which are commonly called the Poles; whereof the one representing the North point is called the *Pole Articke*; the other shewing the South, is termed *Antarticke*. To this Meridian Circle in the Globe is commonly fastned a litle Brasen Circle, named *Cyclus horarius*, or the *houre-circle*; but this rather appertaines to *Astronomy* then *Geography*, and therefore we will forbear to describe it: Somewhat more vse haue we of another Instrument fastned to the Meridian, called the *Quadrant of Latitude*; forasmuch as it may serue to measure the Distance betwixt any two places signed in the Globe; but in so grosse an Instrument litle exactnesse can be expected. Now for such matters as are inscribed in the Spheare it selfe, (to let passe ridiculous & idle pictures vsed of Painters for ornament) they are either lines & Circles drawne on the face of the Globe: or else the pictures & deli-

delineations of Countreies and places, marked out in visible proportions; whereof the former properly appertaines to the *Spherical* part of Geography; the latter to the *Topicall*. The Circular Lineaments are againe twofold; either Circles necessarily appertaining to the constitution of the Globe; or else Lines thereon drawne to be considered of Marriners, which we haue before called the *Rumbes*. But these Lines also (as we haue taught) appertaine to the *Geographer*, being as so many sections of the Horizontall Circle; because they are alwayes imagined to proceed from a Veticall point wherein they meet. The Circles painted on the Globe are either the *Parallels* or *Meridians*, whose description we haue set downe in the chapter before: Amongst the Parallels the most remarkeable is the *Aequatour*, which is made greater then all the rest, in forme of a bracelet, distinguished into degrees, and marked at euery 10. degrees: Next to this are the Tropicks and Polar Circles, represented only by blacke Lines, yet framed in such sort, that they may easily be discerned from other Parallels. Amongst the Meridians the most notable is the first Meridian passing by the *Canaries*, and painted much like the *Aequatour*, cut into diuers sections and degrees; in such sort as we haue described For the *Zodiack* which is vsually pictured in the Terrestriall Globe, I hold it altogether needlesse in Geography, and made rather for ornament, then vse; forasmuch as the Periodick course of the Sun, deciphered by the Ecliptick, appertains rather to the *Theory* of the Planets, which is the hardest part of *Astronomy*. The proportion of these Circles, Site, and Distance is taught before, and needs no repetition, sith it is the very same in representation on the face of the Globe, which is really in the Earth it selfe. For the Pictures and Topicall description of the Earth, we referre it to the second & third part of this Treatise; where we shall haue occasion to speake of Countreies and Regions, with their seuerall qualities, accidents, and dispositions.

- 2 The Use of the Artificiall Globe is to expresse the parts of the Earth so farre forth as they

haue a diuerse situation aswell one in respect of another, as of the Heauens.

The vse of the Artificiall Globe is two-fold, either generall or speciall: the Generall is expressed in this Theoreme: the Speciall shall be shewne in diuerse speciall propositions hereafter as occasion shall serue:

5 The Direction is taught in the Rule.

1 *The Meridiao for the place being found by the Sunne or Compasse. 1 Let the Globe bee so set, that the North Pole respect the North, the opposite the South. 2 Let the Pole in the Meridian of the Globe be set according to the elevation of the Pole at the place assigned.*

6 A Geographicall Mappe is a plaine Table, wherein the Lineaments of the Terrestrial Sphcare are expressed and described in due site and proportion.

Some would haue the name of a Mappe to be drawne from the linnen furniture wherewith it is endorfed; which is not vnlikely, in regard of the affinity of the words in Latine. But more significantly by others it is termed a Geographicall Table or Chart: A Mappe differs from a Globe, in that the Globe is a round solide body, more neerely representing the true figure of the Earth, whereas contrarywise the Charts of themselves are plaine, though representing a Spheare, invented to supply the want of a Globe. For whereas a Globe is more costly to be procured of poore Students, and more troublesome to be carried to and fro; a Mappe is more cheape to be bought, & farre more portable: And howsoeuer it be not so apt an expression as the Globe, yet are there few matters represented in the other, which may not in some sort find place in this. And certainly

tainly such is the vse and necessity of these Tables, that I hardly deeme him worth the name of a Scholler, which desires not his Chamber furnished with such ornaments. It is written of that learned man *Erasmus Roterodamus*, that hauing seene 50 yeares, he was delighted so much with these Geographickall Mappes, that vndertaking to write Comments on the *Acts* of the *Apostles*, he had alwayes in his eye those Tables, where he made no small vse for the finding out of the site of such places whereof he had occasion to treat. And it were to be wished in these dayes, that yong Students instead of many apish and ridiculous pictures, tending many times rather to ribaldry, then any learning, would store their studies with such furniture. These Geographickall Mappes are of two sorts, either Vniuersall or Particular: The Vniuersall are such as represent the picture of the whole Earth. The particular are such as shew only some particular Place or Region. These particular Tables are again of two sorts; some are such as describe a place in respect of the *Hesuens*, whereon are drawne the Geographickall lineaments by vs described, at least the chiefeest: some again are such as haue no respect at all to the Hesuens; such as are the Topographickall Mappes of Cities and Shires, wherein none of the Circles are described. For the Vniuersall & first sort of particular Mappes, there is no question but they properly appertaine to Geography: But the later deserue much lesse consideration, as being too speciall for this generall Treatise.

- 7 The Geographickall Mappe is twofold: either the *Plaine Chart*, or the *Planisphære*: The *Plaine Chart* we call that which consistes of one face and Right lines.

Such a Chart we find commonly set forth vnder the name of the *Marriners Sea-Chart*: for howsoeuer it seemes to haue chiefeest vse in Navigation, yet is the Nature & vse of it more generall: as that which not onely expresth the *Sea*, but the whole *Terrestriall Globe*: Forasmuch as the *Parallels*, *Meridians*,

dians, and *Rhumbes*, whereof primarily it consists, are circles common to the whole, and not appropriated to either part.

3 In the *Plaine-Chart* we are to consider. Two things. First the *Ground*. Secondly the *Inscription*. The *Ground* is the space or Plat-forme wherein the Lines are to be inscribed: the *Inscription* teacheth the manner how to project the Lines.

In the Chart two things are remarkeable; to wit, the plaine whereinto the Lines are inscribed: Secondly the Lines or *Inscription* it selfe: so we are heere to handle two points: First how this *Plaine Chart* should be conceiued to bee produced out of the Globe; whereof it is a representation. Secondly, what rule or methode we ought to vse for the inscription of the Meridians, Parallels, Rumbes, and other Lineaments therevnto annexed. Both which depend on these Propositions.

I The *Geographical Chart* is a *Parallelogramme* conceiued to be made out of a *Spheare*, inscribed in a *Cylinder*, every part thereof swelling in *Longitude* and *Latitude*, till it apply it selfe to the hollow superficies of the said *Cylinder*.

This Theoreme seeming at the first obscure, consists of many parts, which being once opened, will soone take light. First then to know the Ground-work of this *Parallelogramme* thus defined, we must suppose a Sphæricall superficies, Geographical or Hydrographical, with Meridians and Parallels to be inscribed into a concaue *Cylinder*, their Axes agreeing in one. Secondly we must imagine the superficies thus inscribed, to swell like a bladder, blowing æqually in euery part, as well in *Longitude*, as *Latitude*, till it apply it selfe round about, and all along towards either Pole, vnto the concaue superficies of the *Cylinder*; so that each *Parallell* on this superficies, successiuey grows

growes greater from the *Æquinoctiall* towards either Pole, vntill it challenge a quall Diameter with the Cylinder: and likewise all the Meridians growing wider and farther off, till they be as farre distant euery where as is the *Æquinoctiall* one from the other. Hence may easily be vnderstood the true Mathematicall production or generation of this part: for first of a Sphæricall superficies it is made a Cylinder: and secondly of a Cylinder it is made a Parallelogramme, or plaine superficies: For the concaue superficies of a Cylinder is nothing else but a plain Parallelogramme, imagined to be wound about two æquall æquidistant circles, hauing one common Axel-tree perpendicular vpon the Centers of them both; and the *Peripheries* of them both, æquall to the length of the Parallelogramme, as the distance betwixt those Centers is æquall to the bredth thereof: In this Chart so conceiued to be made, all Places must needes be situate in the same Longitudes and Latitudes, Meridians, Parallels, and Rumbes, which they had in the Globe it selfe: because we haue imagined euery point betwixt the *Æquatour* & the Poles, to swell æqually in Longitude and Latitude, till it apply it selfe to the concauity of the Cylinder: so that no Pole can be displaced from his proper seat, but only dilated in certaine proportion. And this I take to be the best conceit for the ground-worke or platforme of this Geographickall Chart.

2. *Except the distances betwixt the Parallels in a Plaine-Chart be Varied, it cannot be excused from sensible error.*

It hath bin thought by many Geographers, that the Earth cannot aptly according to due symmetry and proportion be expressed in a plaine superficies, as it is in the Globe: forasmuch as that which is ioyned and vnited in the Globe, being of a Sphæricall figure, is in the Mappe extended and dilated to a diuerse longitude and latitude from that Sphæricall delineation: and although it hath bin generally conceited by many writers, that no due proportion could be obserued in a Sphæricall superficies, without sensible error: yet most exception hath bin made against this Chart here mentioned, consisting of one face

and streyte lines, which in substance (if we consider the Circles) differs not from the Nauticall Chart: of whose errors *Martin Cortese*, *Peter Nonnus*, and many others have complained: which escapes are excellently opened and reformed by our Countryman *Edward Wright* in his *Correction of Nauticall Errours*. The reason or ground which drew these men to think that the Earth could not be proportionably described in a plaine superficies, proceeded from the common proportion of the Lines and Circles on the Chart. For supposing the Parallels cutting the Meridians at equall Angles, to obserue an equall distance euery where one from the other; these errors and absurdities must of necessity ensue. First, what places soeuer are delineate in the ordinary Chart, the length of them from East to West hath a greater proportion to the breadth from North to South then it ought to haue, except onely vnder the Equinoctiall: and this error is so much the more augmented, by how much those places are distant from the Equinoctiall: for the nearer you approach the Pole, the proportion of the Meridian to the Parallell still increaseth; so that at the Parallell of 60 degrees of latitude, the proportion of the length to the breadth is twice greater then it ought to be; forasmuch as the Meridian is double to that Parallell, and so in all the rest: whence as *Edward Wright* obserues, the proportion of the length of *Friesland* to the breadth thereof, is two-fold greater then in the Globe which expresseth the true proportion; because the Meridian is double to the Parallell of that Island. In like sort it is plaine, that in the Islands of *Grock-land* and *Groen-land*, the length to the breadth hath a foure-fold greater proportion in the common Chart, then in the Globe; because the Meridian is foure-fold greater then the Parallell of those places. Wherefore it cannot be conceited, that the manner of finding out the difference of Longitude by the common Chart, can be any where true without sensible error, except onely vnder the Equinoctiall, or neare about it; because in no other place the Parallell is equall to the Meridian. In other places the error will be sensible, according to the difference of the Meridian, and Parallell of that place: whereas if the contrary were

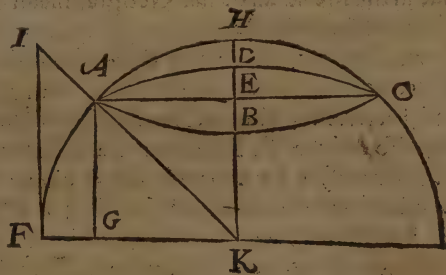
were granted, it would follow, that two ships sayling from North to South, vnder two seuerall Meridians, would keepe the same distance the one from the other of longitude neare the Pole, which they had neare the Æquator; which is impossible: because Meridians cannot be Parallell the one to the other, but by how much they approach the Pole, by so much they are nearer, that in the end they all concurre and meet in the Pole it selfe. Secondly this common Chart admitted, there would arise great errors not only in the situation of diuers places, which appeare to be vnder the same Meridian, but also in the bearing of places one to the other. The reason is manifest, for that the Meridian is a certaine Rule of the site and position of places: therefore whensoever any error shall be committed in the Site and Position of the Meridian, there must needs follow errors in the designation of the Rumbes, and other points of the Compasse. And therefore euery respectiue position of place to place, set downe in the common Chart, cannot be warranted. A pregnant example we haue in the way from *India*; for the Promontory of *Africke*, called the Promontory of three Points, hauing of Northerne latitude 4 Degrees and a halfe, & the Island of *Tristan, Acugna*, hauing 36 degrees of Southerne latitude, are in the common Chart set vnder the same Meridian: But the Chart sheweth the distance betweene these Islands, and the *Cape of good Hope* to come neare to 400 leagues; both which cannot stand together; for if all the coast from the Promontory of *Three Points*. vnto the *Cape of Good-hope* be rightly measured, and the Promontory of *Three Points* lye also vnder the same Meridian with those Islands, yet must the distance be much lesse: But if it be not lesse, it cannot stand with reason that it should haue the same Meridian with the Promontory of *Three Points*, but must needs lye more Westward. Thirdly, there must needs arise a greater error in the translating Sea-coasts and other such Places out of the common Chart, into the Globe; because they haue only a respect to the Numbers of Degrees of Longitudes and Latitudes found therein; so that not only errors appeare in the Sea-Chart, but also other-where thence deriued. These and many more errors haue bin

detected in the cōmon Sea-chart, which (as we haue said) respecting the circles, ought to be imagined one & the selfsame with the projection of the lines in a Geographical table; which oversight *Ger. Mercator* in his vniuersall Map seemes to correct: yet leaues no demonstration behind him to teach others the certain way to draw the Lines, as Meridians, Parallels, & Rumbs on the Chart, in such sort, as these errors might be prevented, and the due proportion and symmetry of Places well obserued. But our industrious Countryman hath waded through all these difficulties, and found out the true demonstration of a projection of these Lines to be inscribed in the Chart in such sort, as no sensible error can shew it selfe, from whose copious industry we will extract so much as may serue our purpose, only contracting his invention into a shorter methode, hauing many matters to passe through in this Treatise.

2 *The Distances of the Parallels in the Chart must encrease proportionably as the Secantes of the latitude.*

It hath bin a conceiued error (as we haue shewed) that all the Parallels in the Chart here mentioned, should euery-where keep the same Distances one from the other, from the Æquator to the Poles; yet because no man (for ought I know) hath out of Geometricall grounds discovered the true proportion, beside my fore-named Author; I must heerein also follow his direction as neare as I can in his owne footsteps; because I would not any way prejudice his Invention. First therefore we must consider in that Chart, because the Parallels are æquall one to the other, (for euery one is set æquall to the Æquinoctiall) the Meridians also must be Parallell and straight Lines, & by consequence the Rumbes, making æquall angles with euery Meridian, must be also straight lines. Secondly, because the sphericall superficies whereof the Chart is imagined to be produced, is conceiued to swell and enlarge it selfe euery-where æqually, that is, as well in Longitude as Latitude, till it accomodate it selfe to the hollownesse of the Cylinder round about; therefore at euery point of Latitude in this Cylinder so dilated, a

part of the Meridian obtains the same proportion to the like part of the Parallell, that the like parts of the Meridian and Parallell haue to each other in the Globe without sensible error. Now forasmuch as like parts of the wholes, haue the same proportion that these wholes haue; therefore the like parts of any Parallell or Meridian of the Sphaere haue the same proportion that the same Parallels and Meridians haue. For example sake, as the Meridian is double to the Parallell of 60 Degrees, so a Degree, Minute, or other part, is also double to a Degree, Minute, or other part of the Parallell; and what proportion the Parallell hath to the Meridian, the same must their Diameters and Semi-diameters haue one to the other: as is taught by Geometricians. Now the Sine of the Complement of the Parallels latitude or distance from the Æquinoctiall, is the semi-diameter of the said Parallell; as in this Diagramme here inserted may easily appeare: for



$ABCD$; & as
 the semi-diameter of the Meridian or whole sine is to the semi-diameter of the Parallell; so is the secant or Hypotenuse of the Parallels latitude to the semi-diameter of the Meridian, or to the whole sine, as FK (that is) AK , to AE (that is) GK , so is IK to FK : therefore in this Geographical Chart, the semi-diameter of each Parallell being equal to the semi-diameter of the Equinoctial or whole sine, the parts of the Meridian at every point of latitude, must of necessity increase with the same proportion wherewith the Secants of the Arch contained between these points of latitude and the Equinoctial increase: out of which Geometrically

grounds thus explained, will arise a certaine and easie methode for the making of a table by the helpe of Trigonometry, whereby the Meridian in any Geographical or Hydrographical table may truly and in due proportion diuide it self into parts, from the *Æquinoctiall* towards either Pole: for taking for granted, that each distance of each point of latitude, or of each Parallell one from the other, to comprehend so many points as the secants of the latitude of each point or Parallell contains, we may draw out a table by continuall addition of the secants answerable vnto the latitude of each Parallell, vnto the summe compounded of all the former Secants; beginning with the secants of the first Parallels latitude, & thereunto adding the second Parallels latitude, & to the summe of both these, adding the third Parallels latitude, & so forth in all the rest; and this Table will shew the sections and points of latitude in the Meridian of the Geographical Mappe; through which sections the Parallels ought to be drawne: which Table we haue lately set out by *Edward Wright* in his *Correction of Nauticall Errours*, to whom for further satisfaction in this kind, I referre the diligent Reader. Out of the same grounds we may also deduce the Rumbes: for sith that the Chart (as we haue shewed) is nothing else but a plaine *Parallelogramme*, conceiued to be made of the extension of a Sphæricall superficies, inscribed in a concaue Cylinder, it must needs be that the Rumbes make π quall Angles with all the *Meridians*. Therefore if in the Chart a circle be drawne, diuided into 32 π quall parts, beginning with the *Meridian*, passing by the Center of that Circle, the lines drawne from the center of these sections, will be the Rumbes for that place.

9 Of the Geographical *Plaine-Chart* we haue spoken; It behoues vs next to treat of the *Geographical Planisphære*. The *Planisphære* is a table or map of two faces, whereon the lines are projected circularly.

Betwixt

Between the Planisphere and the Plaine-Chart, a double difference may be obserued: 1 That the former consists altogether of right lines, as well in regard of the *Parallels* as *Meridians*: whereas the later is composed of circular or crooked lines, as well as right. 2 The former may well be expressed in one forme or front, as we may see not only in the Nauticall and common Chart, which we haue shewne to be all one with the other in respect of these Lines; but in many other common Mappes, as namely those of *Hondius*, whereas the Planisphere cannot be expressed without two faces or Hemispheres; whereof the one represents the Easterne, the other the Westerne part of the Terrene Globe: For herein we must imagine a Globe to be cut into two æquall Hemispheres, which are at once represented to our sight: of this Description of the Earth by crooked Lines, *Ptolomy* in his 24. Chapt. of his Geography hath taught vs two wayes: whereof the first depends from the aspect of a Spheare, turned and moued round, in which all the Meridians are described as right Lines; but the Parallels as circumferences or crooked Lines. The other Delineation takes his ground from a Spheare presented to the sight, not moued, but resting still in his place, in which both Meridians and Parallels are drawne circular. These two wayes of *Ptolomy* (howsoever iudiciously invented in those times, wherein a small part of the Earth was discovered, and Geography very vnperfect) haue bin by later Geographers much reformed and corrected. Yet amongst the later haue not all expressed themselves alike: some haue portrayed out the Earth in fashion of a Heart; some according to other figures: but in this (perhaps) as Painters, they haue bin more indulgent to fancy, then common vse: others haue gone about to expresse the Globe of the Earth in Ellipticke Lines, which the *Mechanicians* call ovall. But we as well in this as other matters, preferring choice before abundance, will content our selues with one or two, which yf hath stamp more current, and experience hath found most vsfull: to which as a ground we will premise this Theoreme.

1. *The Planisphere is grounded on a certaine aspect*

Orontius.

Gerard Mercator.

aspect of the Terrestriall Spheare, wherein the Eye of the beholder is so conceived to be fixed in some point of the Globe, that it may see the one halfe or Hemisphære.

Concerning the position of the Eye, two things are here remarkable: 1 Where the Eye is supposed to be placed either about the convexe superficies, or in the concaue: some seeme to place it about the convexe superficies; of which opinion *Gemma Frisus* seemes to be, who would haue the Eye to be set at an infinite distance: others although not admitting of such an infinite distance, deny not the Eye to be about the convexe superficies; but neither way can be warranted: Not the former, because of the impossibility of the supposition. For to imagine the Eye to be set at an infinite distance, were to deny a sight or aspect which they would haue to be the ground of this projection: For no object can be perceived, but such as is bounded and determined in a certaine and proportionate space. Neither can the later way passe cleere without exception; because to such a projection, such a sight is required which can see the whole Hemisphære: for otherwise would it be vnperfect, and want of the perfection of the Globe: which containes two absolute and entire Hemisphæres. But now no place can be imagined without the Globe, wherein the Eye can be so placed, as to see the one halfe or Hemisphære: forasmuch as it is impossible from the opposite points of any Diameter, to draw two tangent lines which may meet together, or cut one the other in the same point, but will be Parallell the one to the other: wherefore we may conclude, that the Eye in this projection cannot be imagined without the convex surface of the Spheare, but rather in the concaue: How the Eye should be imagined to be in the concaue superficies, may be in this sort explained, we must suppose a great Spheare of Glasse, or other such Diaphanous matter, inscribed with all his Parallels and Meridians, in such sort as they are represented vnto vs in the Globe, the Eye (according to optically Principles) may be so placed neere the

center

Center of it, as it shall bee able to see precisely the one Hemisphere described with all his circles, as we finde it in the Hemisphere. I say *neere* not in the Center; because the *Angle* of vision (as we finde it taught in the *Perfectures*) doth not extend to a right Angle, but is somewhat lesse: 2 we must inquire in what point in the superficies the eye is placed. To which we answer, that the place of the eye is of it selfe indifferent; because it may be imagined any where in what point soever. Neuertheless we will only fasten on two especiall waies which are of most use, wherein the propositions following shall informe vs.

9 This Planisphere is twofold: the first wee tearme æquinoctiall, which supposeth the eye to be fixed on some point of the æquinoctiall circle; the other Polar wherein the sight is conceiued to bee fixed on the Pole of the Terrestriall Globe: The ground and fabricke of the former is taught in these Propositions.

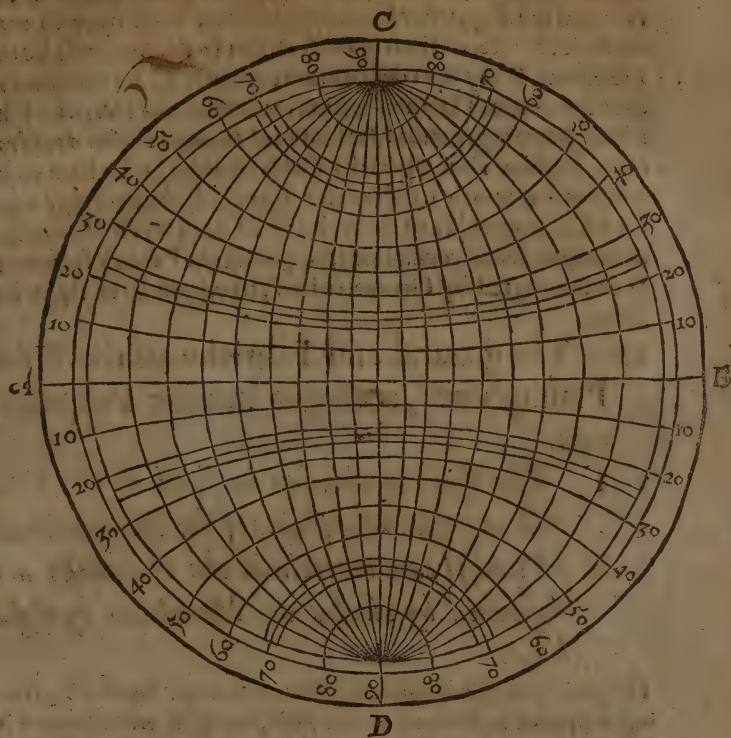
I The eye conceiued to be fixed on any point of the æquatour, will designe out vnto vs a Planisphere wherein all the circles are projected circularly, except the Æquatour & that Meridian which passeth by the said point.

This may easily be shewne out of Opticke principles, we will suppose for example sake the eye to bee placed in some point of the Æquatour: which shall bee 90 degrees of Longitude from the Æquinoctiall point: which kinde of projection wee haue in many of our common Geographicall Mappes of the earth. In this manner of sight, if the terrestriall Hemisphere, which may onely bee comprehended by it, be distinguished by his Parallels and Meridians or-

dered and ranged by distances of equall Arches in such number as we please: It is most certaine that the Eye, seeing distinctly and separatly euery one of these Meridians and Parallels, will forme to it selfe so many visuall Pyramides, called by Geometricians Cones, which cones by this meanes will be Scalenes, & will haue for their Bases those Meridians and Parallels, the tops whereof will meet together in the same point and eye of the beholder, which according to this supposition is the Pole of the Meridian, which passeth by the Canaries, called the first Meridian, and representing vnto vs the Æquinoctiall colure. Now because these lines are cut by the plaine of the Meridian passing by the Canaries, it followes out of the same grounds, that their common sections, and that of the Meridian are the portions of circumferences, which represent vnto vs in this Plaine the Meridians and Parallels seene in this maner of sight. Notwithstanding that which is vnder the 90 degree of longitude, as likewise the Æquatour, cannot (according to Opticke demonstration) be seene, but as right lines cutting one the other at Right Angles in the Center of the same Meridian of the Canaries: The Theory being expressed we will in the next proposition shew the manner of projection.

2 *How to describe the Meridians and Parallels in the Æquinoctiall Planisphaere.*

To shew the practise of this Theoreme, let there bee drawne a circle A C B D, as you see in this figure diuided by two Diameters cutting one the other at right Angles in the Center into foure Quadrants, or equall parts: whereof each one is againe to be diuided into 90 degrees. In this the line A B is imagined to expresse the halfe of the Equatour, as the line C D of the Meridian; in which the two points C and D designe out the two Poles. Let a rule be drawne from the Pole C by euery tenth or fift degrees of the halfe circle A D B, and let every section of the Equatour and the rule be precisely noted. In like sort from the point B let the Rule be moued by euery fift and tenth Degree of the semicircle C A D, and let euery severall Interfection of the rule and the Meridian C D be precisely noted. Then placing



cing one foot of the compasse in the line CD (which must bee drawne out longer, because in it the Centers of the Parallels must be found out) let the other be moued in order to euery intersection of the Meridian noted out: and let so many circles be drawne as intersections, which circles will bee so many Parallels. The finding out of the Centers where the stedfast foot of the compasse ought to be fixed in drawing of each circle, is a matter appertaining to Geometricians: who haue taught a way to bring any three points giuen into a circle, and to finde the Center from which it is described. Hauing thus described the Parallels, we must proceed on to drawe the Meridians in this manner: let the one foot of the compasse be placed in the

line AB, from which as the Center by every Interfection of the rule, and the Æquatour forenoted, let there be drawne so many circles as interfections; which circles so drawne will be the Meridians. If any man desire more curiously to be informed in the Geometrical Demonstrations, whereon this Fabrick of the Planisphære is grounded, let him read *Gemma Frisius de Astro-labio*, *Stifelius*: but especially *Guido Vbaldus*, who hath copiously and accurately handled this subiect. Enough it may seem for a Cosmographer to shew the vse of it, as we shall hereafter in Geographickall conclusions, supposing the Fabrick sufficiently demonstrated by Geometricians, to whom it of right belongs.

10 The ground and Fabricke of the Polar Planisphære, is taught in these Propositions.

- 1 *The Eye conceiued to be fixed on the Pole will expresse in the plaine of the Æquinoctiall a Planisphære wherein all the Parallels are described by circles and Meridians by right lines.*

This may likewise be optically demonstrated: For the Eye being supposed to be fixed on the Pole, the sight will forme to it selfe so many visuall Cones as there are Parallels described in the Spheare. These Cones being supposed æqually to be cut by the plaine of the Æquatour, will haue for their Bases the said Parallel circles represented in the plaine of the Æquatour, as so many absolute circles; whereof the Æquatour will be the greatest, and comprehending within it all the rest. Likewise the Meridians in this kinde of sight are supposed to terminate the sides of these Cones, and therefore according to the Optickes ought to be right lines.

- 2 *How to describe the Parallels and Meridians*

ans in the Polar Planisphaere.

This projection is easiest of all, as shall appeare by this Diagram. Let there be described a circle from the Center E which shall be A C B D: Let this circle be by two Diameters A B & B C divided into four quadrants: each of which may againe



be divided into 90 parts: every fift or tenth of these 90 parts being first marked out, so many Diameters may be drawne from either side to the opposite part by the Center E: which Diameters so drawne will serue for the Meridians. Then let any one of these lines be diuided into 9 parts, and diligently marked out, as the Semidiameter E D by F G H I K L M N: by

all which marks from the Center E, let there be drawne so many circles. These circles so described will be the true Parallels: This kinde of proiection, though more vnusuall, yet wants not his speciall vse in describing the parts of the earth neare the Pole, which in our ordinary kinde of Tables projected after the other manner, cannot suffer so large and proportionall a Description.

II Having hitherto treated of the *Common* representation of the Terrestrial Globe, we are in the next place to speake something of the *Magneticall*. The Magneticall is a round Magnet called a *Terrella*.

This kind of sphear hath bin by *Gilbert* aptly termed a *Terrella*, or little Earth, being the model & representatiō of the great and massie Spheare of the earth whereon wee dwell. Betwixt this kind of representation and the former, great difference may be obserued. First because the former is grounded meerely on *Artificiall Imitation*, implying nothing else but a *Respect* or application: whereas this magneticall *Terrella* not only represents Externally the Earth, but Internally out of its owne *Magneticall* nature and vigour, eminently containes and expresse all those motions and magneticall vertues, which we haue formerly shewed to be in the Earth. 2 It skills not in the former of what *materiall substance* the Spheare consists, so the parts of it answered in due symmetry and proportion to the parts of the Earth; but this represents the whole as a *Homogeneall* part communicating the same nature & substance with the whole spheare of the Earth: In the *Fabrick* of this Instrument wee must consider, 1 the *Matter*: 2 the *Forme*: The matter (as we haue already intimated) is a *Magneticall* substance which ought to be chosen out of a most eminent Mine, hauing all his parts pure and vnmixt, as possible we can finde in any Magnet. For though all Loadstones haue the same inclination, yet in many the vigour is so weake, or at least so hindred by the mixture of some

some *Heterogeneall* matter, that they will not so well and sensibly performe their office. The forme of it is the roundnesse and politure, wherein Art should shew as much exactnesse as she can: such a Spheare may well be expressed in this Figure, whereof we had formerly occasion to make vse: wherein the footsteps of this Magneticall vigour are sensibly expressed, no otherwise then in the great Body of the Earth.



- 12 In this Magneticall Terrella two things are chiefly to be noted, 1 the inuentio of the Poles, 2 of the *Parallels* & *Meridians*: both which shall be taught in these Propositions.
- 1 To finde out the Poles in the Magneticall Terrella.

To performe this conclusion many artificiall waies haue beene invented, 1 By the *Inclimatory* Needle: for being evenly hung in such sort vpon the Terrella, as may be seen in the former figure it will according to diuers points diuersly respect the Terrella

in his site: where soeuer then we shall finde it to fall perpendicularly at right angles, we may assure our selues that that very point is the Pole: which being once knowne, it will be easie to finde the opposite Pole, either the same way, or by measuring. 2 By the Veyne or Mine of the Loadstone: for (as wee haue shewed in our fourth Chapter of this Treatise) that part which was situated towards the North, will afterwards direct it selfe Southward, and contrariwise, the South point will respect the North, whence the Poles may be discovered. 3 By a little boat, wherein the Loadstone being placed on the water, will moue round till such time as with one Pole hee may point out the North, with the other the South. Many other waies may be inuented by Mechanicians, perhaps more curious, to whose industry I referre my ingenious Reader.

2 *The circles in the Terrella are found out by the Magneticall Needle.*

This needs no other ocular demonstration then we haue taught in the fourth Chapter, and may bee conceaued in the former Diagramme; First wee see the magneticall needle according to diuerse points diuersly to conforme it selfe, which hath given way to ingenious artificers to finde out the Parallels and Meridians. The Parallels are found out by obseruing the Angles of declination of the Needle hung ouer the Terrella which are found in proportion to answere to the degrees of Latitude; which Dr Ridley in his Magneticall Treatise hath industriously calculated, as I haue here inserted, to saue others a new labour of calculation. The Meridians are more easily found by hanging any directory wiew or needle ouer the Terrella; one end of which pointing towards the North, and the other towards the South, will discover the Meridian line.

A Table

C H A P. VIII.

Of the measure of the Terrestriall Globe

- 1 **H**itherto haue we handled the Terrestriall Globe primarily : in such proprieties as absolutely agree vnto its nature. In the second place wee are to handle such as secondarily arise out of the former. Here we are to handle two chiefe points. 1 *The Measure.* 2 *The Distinction.*
- 2 The measure is that by which we find out the quantity of the whole Earth.

Good reason haue we to call this the *Secondary* part of *Geography*: forasmuch as these accidents and proprieties we here consider, arise altogether out of the former. In the former Treatise we haue diuided the *Naturall* Spheare of the Earth, from the *Artificiall*: But in this part, for avoiding of tedious repetitions of the same things, we haue ioyned them together: For howsoever the measuring and distinctions of the Earth be truly grounded on the nature of the earth it selfe; yet can it not be well expressed & taught without the materiall Instrument: we haue therefore thought good to consider the measure of the earth, before we come vnto the Distinction, because it is more simple and vncompound, depending on the lineaments & measure of one circle: whereas the Distinction necessarily requires the conjunction and combination of diuerse circles, as *Meridians* and *Parallels* compared one with the other, as shall bee taught hereafter. Whether the great masse of the earth can be measured, or no, seemes a matter not agreed on by all; Some haue held an opinion that it cannot be measured, in regard of

the infinite magnitude wherewith they thought it endowed: which opinion seemes deriued from some of the *Platonicks*, who ascribing to the Earth another figure besides the *Sphericall*, haue cast themselues vpon vncertainties, and being not able to reduce the Quantity of the Earth according to their owne grounds to any certaine measure, haue denied it to be measurable: But the ground of this opinion we haue taken away before, in prouing the earth to be of a true Sphericall nature, and therefore circumscribed in certaine bounds apt to be measured. Another conceit more absurd then the former, is not only of the common people, whose condition might excuse their ignorance, but of such as would bee esteemed learned; who contend, that the greatnesse of the earth cannot be measured: the onely reasons they can alleadge for themselues are, 1 That a great part of the earth is vnaccessible by reason of steepe rocks, high mountaines, spacious & thick woods, morish fogges, and such like impediments. 2 That the parts of it are for the most part vneuen, and subiect to no regular figure, without the which no measure can be exact. The first cauill is of no moment; because whereas we affirme that the Earth by man may be measured, we hold it not necessary that it should be trauesed ouer by iournies or voyages. Forasmuch as to the finding out of the Quantity of the whole Terrestriall Spheare, it may seeme sufficient to know the measure and proportion of any little part in respect of the Heauens. As for example, what number of *Miles*, *Leagues*, or *Furlongs* answer to any *degree* or *degrees* in the Heauens: wherefore we suppose the Earth to be measured ouer not with our feet, but with our wits, which may by Mathematicall rules bee taught to march forward where our legges fayle vs: The second obiection only proposes thus much, that the Earth partaking of so many vnequal parts & irregular formes, cannot in the measuring admit of so much exactnesse, as if it were endowed with one vniforme face: yet it is exact enough to content a *Cosmographer*, who measureth not by feet and inches, but by leagues and miles, in which wee little regard such a needlesse curiosity.

I The cōmon measure by which the quātity of the earth is known, are *Miles*, & *Furlongs*.

Here is to be noted that, such instruments as serue for measuring are of two sorts, either greater or lesser; the smaller are of diuerse sorts, as a *Graine*, *Inch*, *Foot*, *Pearch*, *Pole*, and such like. Some of these howsoeuer sometime vsefull in *Topographie*, can haue little or no vse at all in the vast greatnesse of the whole Earth. Wherefore the *Geographer* seldome descends so lowe, but takes notice of greater measures, such as are *Miles* & *Furlongs*: where we may obserue by the way, that the vsuall measuring amongst the *Grecians* was by *Stadia* or furlongs, amongst many of the *Latines* by *miles*; vnder which wee also comprehend *Leagues*: these miles are diuersly varied, according to the diuersity of Countries, so that in some places they are esteemed longer, in other shorter: which differences may be learned out of this ensuing Table.

The instruments of measuring the Earth are	1 Furlong containing 125 Geometrical paces or 625 feet.			
	1 Proper containing 8 Furlongs or 1000 paces.			
	2 Mile which is either	1 Old, containing 12 Furlongs.		
		2 Newer containing 16 Furlongs.		
	2 Improper, which is either	3 Common of 24 Furlongs.		
		1 Common, which is 32 Furlongs or foure Italian miles.		
		2 German mile which is either the		
		1 Greatest containing 5000 paces which is called the <i>Suebian</i> , or <i>Helvetian</i> mile.		

Howsoeuer this Distinction of miles may be many waies profitable, especially in the Topographical part, yet shall we seldome make vse of any other then the common *Germane* mile, or the common *Italian* mile: To which as the most knowne, the rest may easily be reduced.

- 3 The object here proposed to be measured is the Spheare of the Earth. The Dimensions according to which it is measured, are either *Simple* or *Compound*.
- 4 The simple is twofold, either the *Perimeter*, or the *Diameter*. The *Perimeter* otherwise called the circumference, is a great circle measuring the Earth round about.
- 5 The *Invention* of the *Perimeter* of the Earth depends on these following Propositions.

1 If two or more circles be drawne about the same Center, and from the Center to the Circumference be drawne two right lines; The Arches of all the Circles comprehended within the said right lines will be like and proportionall one to the other.

This Proposition being meerely Geometrical, is taken here as a ground without farther demonstration: whereof if any man doubt, he may haue recourse to *Clavius* Commentaries vpon *Iohannes de Sacrobosco*. This principle granted will beget these two Consequencies.

1 As one degree is to the number of correspondent miles, or furlongs, so all the degrees of the circles to the number of miles or Furlongs measuring the quantitie of the Perimeter of the Earth.

2 Wherefore one degree or portion of the Circle

cle being knowne by his number of miles or furlongs, the whole Circumference may be found out.

The reason of this consequence every *Arithmetician* can easily shew out of the *Golden Rule*: The chiefe point then of the invention consists in finding out the proportion of any portion, as a degree, halfe degree, or the like; to the number of miles or Furlongs answerable therevnto; for which purpose many skillfull *Mathematicians* haue invented many excellent waies of great vse and delight.

1. *By the elevation of the Pole, or observation of an Eclipse, or some knowne Starre, the circuit of the Earth may be found out.*

By the Elevation of the Pole it is performed after this maner: let there be obserued two *Cities*, or other notable *Land marks* placed iust North and South vnder the same Meridian. In these two *Cities*, or markes, let the Elevation of the Pole be exactly noted. Then subtract the Elevation of the Southerne *Cittie* which is lesser, out of the Northerne, which is greater: the residue contains the distance of these places in degrees; which being experimentally knowne by Miles, Halfe-miles, Furlongs or such like measures, will shew the true proportion betwixt a degree, and his number of miles: which being againe multiplied by 360, will shew the whole circumference of the Earth. For example sake, we will take two famous *Cities* of *England*, *Oxford* and *Yorke*; which are situated, it not exactly, yet very neere the same Meridian. The elevation of the Pole here with vs at *Oxford* is 51 degrees and 30 minutes; at *Yorke* it is 54 degrees 30 minutes, or neere there about: subtract the lesser from the greater, the distance betwixt *Oxford* and *Yorke* will be three degrees; which distance experimentally knowne in miles, will shew the proportion: which we shall finde to bee, (abating somewhat in regard of the crookednesse of the way) about 180, answering to three degrees of the Meridian:

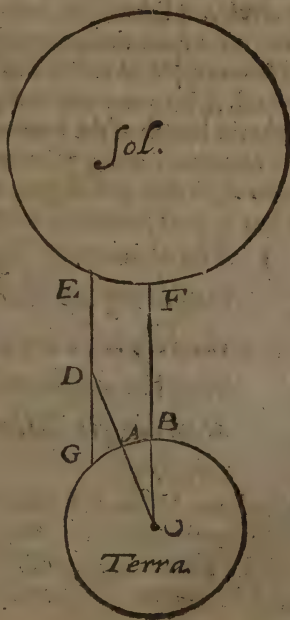
wherefore to one degree will answer 60 Miles, which being multiplied by 360, the whole circle will produce 21600, the measure of the whole Earth. The like may be performed by an Eclipse in two Citties lying vnder the Equinoctiall circle: two land-markes being once noted out, lying vnder the Equinoctiall, let there bee obserued in both the same Eclipse of the Moone, especially in the beginning: Now it being certainly found out how many howres the Eclipse beganne in the one place before the other, we must resolue their howres into degrees, which is easily done: forasmuch as to euery houre answers 15 degrees in the Sunnes Diurnall motion, according to Astronomers. Now the distance betweene these two Citties or markes (being supposed first experimentally to bee knowne, will easily shew the correspondency betwixt the Degrees and miles, which is here sought. Another way is taught by *Possidonius*, as easie as the former, which is performed by some noted fixt Starre, as *Oculus Tauri*, *Arcturus*, *Spica Virginis*, or any other; let there bee obserued vnder the same Meridian in the Earth two places, whose distance is experimentally knowne: in both these places let the Meridian altitude of the Starre be fully and perfectly obserued: The difference of these two Altitudes will be the number of degrees betwixt these two places: whence wee may obserue how many miles, or other parts answer to the number of these degrees betwixt these two places. This way by *Clavius* is preferred before the former; forasmuch as it requires not in any place the knowledge of the Elevation of the Pole, which in any place cannot be certainly knowne, without long and diligent search, and obseruation: As for Geographical Tables, they are not alwaies and at all times to be had, at least wor. by credit.

2 *By the obseruation of the Noone-shadomes the measure of the Earth may be found out.*

This way was inuented by *Eratoſthenes* a famous Mathematician: who by obseruation of the Noone-shadomes, obserued at the ſame time at two diuerſe places, ſituate vnder the ſame Meridian, found out the circumference of the Earth. The pla-

ces which he chose for this purpose were *Siene*, and *Alexandria*, situated vnder the same Meridian: the one inclining to the South, the other to the North. The Distance betwixt these two places is supposed to be knowne, whence hee proceeded in this manner: First he erected a *Gnomon* at right Angles on the plaine of the Horizon: when the Sunne was in the beginning of *Cancer* called the *Solstice*, from which he imagined two *Rays* or *Beames* to be cast at Noone: the one passing by *Siene* the most Southerne part, the other by *Alexandria* the most Northerne: so that at *Siene*, the Sunne being then in the *Solstice* passed into the *Center* of the world: the place being supposed to haue beene situate vnder the *Tropicke*: The other passed by the *Vertex* of the said *Gnomon*: whence by proportion of the shadow to the *Gnomon* by a *Geometricall* kinde of working he found out the space betweene *Alexandria*, and *Siene*: which demonstration, for more euidence we will here set down:

Let there bee in the Earth described a circle passing by *Alexandria* and *Siene*; in which let *A* be the place where *Alexandria* stands: *B* the place of *Siene*: the *Gnomon* or *Style* erected at *Alexandria*, *AD*, The Sun-beame carried to the Center of the world at *Siene* *FB*, The Sun-beame passing by the *Vertex*, or toppe of the *Gnomon* seated at *Alexandria* *EDG*, casting his shadow *AG* toward the North: let the *Gnomon* bee conceaued to be prolonged vnto the Center *C*: Now forasmuch as in the *Triangle ADG*, the Arch *AG*, without any sensible difference may bee taken for a *Right line*, hauing an insen-



fible

sible magnitude in regard of the whole Earth: and the Angle A is a right angle, and the two sides AD, and AG knowne: the former by supposition, being a *Gnomon* taken at our pleasure, the latter by any measure, or at least by the knowne proportion of the shadow to the *Gnomon*, according to the Doctrine of Triangles: the Angle ADG will bee knowne; For whereas the sides AD, and AG are supposed to be knowne, their Quadrats also will be knowne, which being equall to the square made of DG, by the 47 proposition of the 1 of *Euclide*, the right side DG will easily bee knowne: out of these grounds by the doctrine of the *Sines* and *Tangents* is easily found out the Angle ADG, and by consequence the alternate Angle ACB, which by the 27 of the first of *Euclide* is equall vnto it: forasmuch as the two Radij FBC and EDG may be supposed to be Parallels in so small a distance as *Alexandria* and *Siene* compared with the *Sunne*: the Angle being knowne, the Arch AB subtended to the Angle C, will also be knowne, which is the space intercepted betwixt *Siene* and *Alexandria*; and for example sake: if *Eratoſthenes* (as some write) found out the Arch AB, to conraine in degrees 85, and experience had taught the length of the Iourney betwixt these two Citties to haue contained 6183 $\frac{1}{2}$ Furlongs: It would appeare by the *Golden Rule* that 360 degrees containing the whole circuit of the Earth must proportionally answere 252000 Furlongs.

- I The opinions of Cosmographers concerning the measure of the Earth, are diuerse: which is chiefly to be imputed to their errour in observing the distances of places experimentally according to Miles, Furlongs, or such like measures.

How many Authors of great name and estimation haue differed amongst themselues, euery man may enforme himselfe out of this Table here inserted. These differences we finde diversly related: but of all others, which Authors haue set forth,

The circuit of the whole earth contains according to	Authors	Furlongs	Miles.
	Strabo and Hipparchus.	252000	31500
	Eratoſthe- nes.	250000	31250
	Poſſidonius & the ancient Arabians.	240000	30000
	Ptolomic.	180000	22500
	The later Arabians	204000	25500
	Italians and Germans.	172800	21600

I preferre the iudgement of Mr *Robert Hues*; Forasmuch as it is not grounded on common tradition, but industriously by himselfe deriued out of the Ancients by diligent search and examination, as by one, whose iudgement being armed as well with skill in the language, as the knowledge of antiquity, scornes to be iniured by translation. What should be the cause of these differences, is a matter which hath staggered curious searchers into Antiquities more then the former. Euery opinion being supported with the names and authorities of such renowned Authors, might challenge a pitch about the measure of my Decision: only I may not be thought ouer presumptuous

ous to coniecture where I cannot define, especially having so good a guid as my forenamed Author, to tread out the way before me. Wherefore supposing as a ground, these Authors so much differing about the measure of the earth, to have been in some sort led by reason. The differences must needs arise out of one of these causes: either the error or negligence of the observers, in trusting too much to others relations without any farther search, or else the defect in the Mathematicall grounds out of which they deriued their demonstration; or the diuersity of measures vsed in this worke: or finally, from the misapplication of these measures to the distances; whence may arise some error out of the experimental measuring of places in the earth. In the first place it may perhaps bee doubted whether *Aristotle* defining the measure of the Earth to be 400000 furlongs, were not deceaued by relations: forasmuch as hee avoucheth it, from the Mathematicians of his times, whose authority and credit for ought we knowe, deserues as well to be forgotten as their names. But this answer might seem too sharp in the other: forasmuch as we finde them registred for Masters in their science, and such as could not easily bee cosened by others impostures. Neither can we imagine the second to bee any cause of their error for the same reason: because the waies these Mathematicians vsed in finding out the circuit of the earth, are by writers of good credit commended to posteritie, as warrantably grounded on certaine demonstrations, being no other then what we haue shewed, before, which admit of no Parallogisme: In the third place we ought to examine whether the diuersity of opinion concerning this matter proceeded from diuersitie of the measures which were vsed in this worke. *Nonnius* and *Pencerus* would needs perswade, that the Furlongs whereby they measured the earth were not the same: *Maurolycus* and *Xilander* talke of diuerse kindes of paces: *Maurolycus* labours to reconcile both, but without effect. First whereas they would haue diuerse kinde of paces, it cannot bee denied: but in the meane time we cannot learne that the *Grecians* euer measured their Furlongs by Paces, but either by Feet, or Faddomes. A Faddome which the *Greekes* call *ᾠσυστά* is the
measure

measure of the extension of the hands together with the breast betwixt, containing six feet: which is a kinde of measuring well knowne vnto our Marriners, in sounding the depth of the Sea. This measure notwithstanding is by many translated a Pace: by what reason, let any man iudge. *Xilander* in translating *Strabo* renders it an Ell: Secondly for a Furlong it containes according to *Herodorus* an ancient *Grecian* writer 600 Feet: which is also testified by *Suidas*, being much later. A Furlong containes 100 Faddomes; euery Faddome foure Cubits. A Cubit, according to *Heron*, a Foot and halfe, or 24 Digits. Now for the varietie of Furlongs, it is true that *Censorinus* makes three kindes. For either it is called the *Italian* consisting of 625 Feet, which is of most regard in measuring the Earth; or the *Olympian* of 600 Feet: or the *Pythian* containing 1000 Feet. But to let passe this latter, we shall finde by serious consideration, that the *Italian* and *Olympian* Furlongs differ only in name, and are indeed the same. For the *Italian* containing 625 *Roman* Feet (according to *Pliny* in his second booke) is equall to the *Olympian*, hauing 600 *Grecian* Feet. For a Foot with the *Gracians* exceeds the *Roman* Foot by a twenty fourth part: as much as is the difference betwixt 600 and 625. Hence we see how little certainty can be expected of such as goe about to reconcile these opinions out of the various vse and acception of the measures. The most probable assertion then is, that the error was grounded on this, that the distances of places, mentioned by the foresaid Authors, were not by themselves exactly measured, but taken vp vpon trust on the relation of traouellers, wherein they might easily be mistaken. For instance we will take *Eratosthenes* and *Possidonius*, as of greatest credit, who are notwithstanding taxed for many errors in their experimentall observations: whereas it is cleere that *Ptolomy* grounded his opinion on the distance of the places, exactly measured, as is witnessed by his designation of the Latitude of the earth so farre as it was discovered and knowne. *Eratosthenes*, for mistaking in the measure of distances, is much taxed by *Hyparchus*, as wee finde in *Strabo*: For betwixt *Alexandria* and *Carthage*, he reckons aboue 13 thousand furlongs, whereas by a more diligent enquiry there

there are found to be but 9 thousand. Likewise *Possidonius* is knowne to be mistaken, in that hee made the Distance betwixt *Rhodes* and *Alexandria* to be 5000 Furlongs, whereas out of the relation of Marriners, some haue made it 4000, some 5000, as it is witnessed by *Eratosthenes* in *Strabo*; who notwithstanding, sayes that he found by Instruments that it was not about 3750; and *Strabo* would haue it somewhat lesse, as 3640. *Marcellinus*, going about to defend *Possidonius* against *Ptolomy*, brings nothing but frivolous reasons vnworthy so good an author. Out of all which hath beene spoken, our former Corollary will be manifest, that the diuersity of opinions concerning the circumference of the Earth, arose from the experimentall mistake in the distances of places, where they trusted to other mens relations, rather then their owne knowledge.

6 The *Diameter* is a right line passing by the Center of the Earth from one side to the other, and measuring the thickeesse of it: the invention of which depends on these Rules.

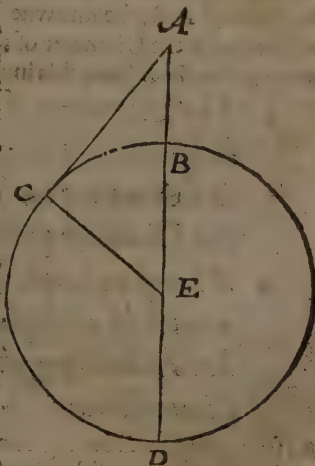
1 As 22 is to 7 so is the circumference of a circle to the Diameter: wherefore the circumference of the Earth multiplied by 7, and diuided by 22 will produce the Diameter.

The exact proportion betwixt the Circumference of a circle, and the Diameter being the ground of the Quadrature of a circle, is a matter which hath set aworke the greatest witts of the world: hauing notwithstanding as yet by no man been brought to discovery, inso much as *Pitiscus*, and other good Mathematicians, might well doubt whether euer it would come to light. Neuerthelesse, where exactnesse cannot be found, wee must come as neere as we can. The neereest proportion in numbers which any could yet light on, is as 22 to 7, which in so great & massie a body, as the Earth may passe without any sensible or explicable error. Supposing then out of our precedent Suppositions the whole

whole circuit of the Earth to be 21600 *Italian miles* (which is the common opinion now receaued) I multiply according to the golden Rule 21600 by 7, whence will arise 151200, which being diuided by 22 the Quotient will render 6872 $\frac{8}{11}$ which is the Diameter or thicknesse of the Earth: some lesse curious are content to take only the third part of the circumference for the Diameter, which will be 7200, which account is lesse exact, yet sufficient for an ordinary Cosmographer: forasmuch as 328 miles, which is the difference, is of no great moment in the measure of the whole Earth.

2. By the knowne height of some mountaine without the knowledge of the circumference of the Earth, the Diameter may be found out.

This is a way inuented by *Maurolycus*, which proceeds in a contrary manner to the former: because the former by the circumference first supposed to be knowne, shewes vs a way to finde out a Diameter: but this, first seeks out the Diameter, by which we may finde out the circumference: the practise is in this manner. Let the circuit of the Earth be conceaued to be B C D (as we see in this Figure) in which let there be chosen an high Mountain whose Altitude A B may be knowne by the rules of measuring altitudes: then from the Mountaines top A, by the rules of measuring longitudes must the whole space of Sea or Land be measured so farre as it can be sen: so that the visuall Beame A C, may touch the Superficies of the Earth in C: let the space the which is seen in the Earth be B C, which although in it selfe it be crooked and not plaine, yet can it not sensibly differ from a Plaine, forasmuch as the Arch B C, is extraordinary



traordinarily litle, if compared with the whole Earth. These grounds thus laid, we must proceed by a Geometrical maner of argumentation in this sort. Here are to bee obserued foure right lines: whereof the first is AB , the heighth of the mountain obserued: the second is the visual Ray AC : the third AD consisting of the heighth of the mountaine, and the Diameter of the Earth. The fourth BC , the distance which is seene; for (as wee haue shewed) it may without feasible error be taken for a right line. Now forasmuch as AB , BC are knowne, their Quadrates by the 47 proposition of the first of *Euclide*, will also be knowne; which being equall to the square of AC , the square of the right line AC will likewise be knowne. But the square of the right line AC , sith it toucheth the circle, will be equall to a Right Angle Figure contained vnder DA , AB , wherefore the right angle so conceaued will be knowne. But AB is the knowne heighth of the mountaine, wherefore the right line AD will easily be knowne; if we diuide the knowne right Angle contained vnder AB , AD : by the right line AB : for the Quotient will giue the right line AD ; from which if we subduct AB , the knowne heighth of the mountaine: then will remaine the Diameter of the Earth BD , which was here to be performed: from this inuention will arise this Corollary.

1 *The Diameter of the Earth first supposed to be knowne the circumference may be found out in this manner: as 7 is in proportiō to 22, so is the Diameter to the Circumference.*

2 *Wherefore let the knowne number of the Diameter be multiplied by 22, and the Product be deuided by 7, the quotient will giue the Circumference.*

As for example according to our former instance: Let vs suppose the Diameter of the Earth to bee 6872 $\frac{8}{11}$; this number being multiplied by 22, will produce 15120, which product diuided

devided by 7, we shall finde in the Quotient 21600, which is the circumference of the Earth.

- 7 The compound dimensions, according to which the Spheare of the Earth is proposed to be measured, are either the *Superficies* or the *Solidity*.
- 8 The *Superficies* is againe twofold, either *Plaine* or *Convexe*: the *Plaine* is the space included in the *Perimeter*.
- 9 The *plaine Superficies* may bee found out two waies: either by the *Circumference*, or the *Diameter*: both which vvaies are taught in these Rules.
1. If the whole circumference be multiplied in it selfe, and the product bee devided by $12\frac{1}{2}$, the quotient will shew the *Superficies* included in the circle.

As in the former example wee will take the *Circumference* of the Earth to be 21600 *Italian miles*: let this number be multiplied in it selfe, and the product thereof divided by $12\frac{1}{2}$, the Quotient will amount vnto 9270180, which is the *plaine superficies* of the Earth.

- 2 If the *Semi-Diameter* of a circle bee multiplied by the halfe part of the *Circumference*: there will arise the measure of the *Plaine Superficies* contained in the *Circumference*.

The reason hereof is shewed by *Clavius* in his *Tract de Superfimetris Proposit. 4.* where is demonstrated, that a Right Angle figure

figure comprehended of the *Semi-Diameter* of any circle, and the halfe of the Circumference will be æquall to the Circle it selfe, of whose parts it is comprehended.

IO So much concerning the *Plaine Superfici-
cies*: the knowledge and inuention of the
Convexe, may bee performed two vvaies:
either by the *Diameter* and *Circumfe-
rence*; or else by the *Space* contained with
in the Circumference, according to these
Propositions.

1 *If the Circumference and Diameter be mul-
tiplied the one into the other, the product will
shew the number of square miles in the face
of the Terrestriall Globe.*

As for example, let the Diameter of the Earth containing ac-
cording to the common account 80111 $\frac{2}{11}$ furlongs, be multi-
plied by the whole circumference, which is 252003, there will
arise the Convexe Superficiēs of the whole earthly Spheare
which is 20205818181 $\frac{9}{11}$.

2 *If the space contained in the greatest circle
in the Spheare be multiplied by 4, there will
be produced the whole Convexe Superficiēs of
the Spheare.*

How to finde out the space or plaine Superficiēs, is a matter
taught before: which being once found is easily multiplied by
4, and so will giue vs the number sought.

II The last and greatest compound Di-
mension, according to which the Earth is
measured is the *Solidity*, cōsisting of *Length*,
Breadth.

Breadth, and Heigth, or Thicknesse: This may be found out two waies: either by the *Diameter*, and *Convex Superficies*, first supposed to be knowne: or by the knowledge of a great circle without supposing the *Superficies* to be first knowne: both waies shalbe expressed in these Propositions.

- 1 *If the Semidiameter of the Spheare be multiplied into the third part of the Convex Superficies of the said Spheare, there will arise the whole Solidity of the Earth.*

This is demonstrated by *Geometricians*: For a solide Rectangle comprehended of the Semidiameter of the Spheare, and the third part of the Convex Superficies of it, will be equall to the Spheare it selfe. As for example, if the Semidiameter of the earth containing 4009 $\frac{1}{2}$ Furlongs bee multiplied by the third part of the Convex Superficies containing, to wit, 67352727 $\frac{3}{4}$, there will arise the solidity of the earth, which will containe 270023206611570 $\frac{3}{4}$ Cubick Furlongs. That is the solidity of the earth will comprehend so many Cubes, containing every side so many Furlongs, as there are vnities in the said number: For the *Area* or spaces comprehended of Solide figures are measured by the Cubes of those lines, by whose squares the Convex Superficies of those lines are measured.

- 2 *If the greatest circle be multiplied by $\frac{2}{3}$ of the whole Diameter: the product will shew the Solidity of the Spheare.*

This way is also demonstrated by *Clavius* in the same tract of measuring Magnitudes. It may Arithmetically be deduced in this sort. If any Spheare whatsoeuer hath a Diameter of 14 Palmes, and should be multiplied by 3 $\frac{1}{7}$, the circumference of

the greatest circle containing it will be found to be 44; whose halfe being 12, if it be multiplied into the S^midiameter 7, there will arise the Superficies of the greatest circle 54, which number if we multiply by two third parts of the Diameter: that is by $9\frac{1}{3}$ there will bee produced the solidity of the said Spheare, to wit, consisting of $143\frac{2}{3}$ Cubick palmes. In the like fort may we worke by miles or furlongs in measuring the whole terrestriall Globe, which is a more convenient measure for the masse Globe of the Earth.

CHAP. IX.

Of the Zones, Climates, and Parallels.

- 1 **O**F the Measure of the Earth vve haue treated in our former Chapter. In the next place vve must speak of the Distinction of the Terrestriall Spheare, vvhich is either in regard of *Spaces* or *Distances*.
- 2 Spaces are portions in the Spheare bounded by the Parallell circles: such as are the *Zones, Climates, and Parallels*.
- 3 These are againe considered tvvo vvaies; either in themselves, or else in their Adjuncts or Inhabitants belonging to them.
- 4 A *Zone* is a space included betwixt tvvo lesser

lesser and named circles; or else betwixt a lesser circle and the Pole of the world.

Th: spaces into which the Terrestriall Spheare is diuided, are either Greater or Lesser. The Greater is a Hemisphære, which ariseth out of one only circle by it selfe, without the Cōbination of more. Such are chiefly of three sorts. The first is made by the Æquatour: which diuides the whole Globe into the north and the South Hemisphære. The second is of the Meridian, whose office it is to part the Earth into the Easterne and Westerne Hemisphæres: The third of the Horizon, which diuides the Spheare into the vpper and lower halves: But these parts arising (as I said) out of one only circle, are handled before with the circles themselves. In this place wee are to speake of such parts, as arise out of the Combination and respect of circles one with another. Such as are the Zones, Climats, and Parallels. A Zone signifies as much as a girdle or band: because by it the spaces in the Earth are (as it were) with larger bands compassed about. The Grecians haue sometimes giuen this name Zone to the Orbs of the Planets, as Theon, *Alexandrinus* in his Comment on *Aratus*, in these words, Ἐπεὶ δὲ ἑκάστη ἡ ζώνη ἓξ ὀρίων τοῦ Ζωδιακοῦ ἔστω, καὶ μὴ πλεονεχέτω ὁ Κρόνος: καὶ ὁ Διὶ πέντε ὁ Ζεὺς. There are (saith he) in the Heauens seauen Zones not conterminat with the Zodiack, whereof the first is possessed by Saturne, the second by Iupiter &c. But this acception of the name is farre off from our purpose. The name Zone, as it is with vs in vse, is by the Latine Poets rendred sometimes *Fascia*, sometimes *Plaga*: both signifying one and the selte same thing: which is as much as a space comprehended within two Named and lesser Parallels: or at least betwixt such a Parallell and the Pole it selfe: because, as we shall shew hereafter Zones are of two sorts: Thele Zones are in number fiue; which diuision hath beene familiar with our Latine Poets, as may appeare by these verses of *Virgil*.

Quing, tenent cœlum Zone, quarum una corusco

Semper Sôlerubens, & torrida semper ab Igne:

Quam circum extrema dextrâ levâq, trahuntur

Z. 2

Caruleâ

*Caruleâ glacie conoreta, atq; imbribus atris.
Has inter, Mediamq; dua Mortalibus agris
Munere concessa Divum, &c.*

Five Zones ingirt the Skies; whereof one fries
With fiery Sun-beames, and all scorched lies.
'Bout which the farthest off on either hand,
The blew-eyed Ice and brackish showres command.
'Twixt these two and the midst the Gods doe giue
A wholsome place for wretched man to liue.
Which description of *Virgil* little differs from that we finde in
Ovid, in these Verses.

----- *Dua dextrâ cœlum totidemq; sinistra
Parte secant Zona: quinta est ardentior illis:
Sic onus inclusum numero distinxit eodem
Eura Dei, totidemq; Plaga tellure premuntur.
Quarum qua Media est non est habitabilis æstu:
Nix tegit, alta duas: totidem inter utramq; locavit.
Temperiemq; dedit mixta cum Frigore Plammâ.*

Two Girdles on the right hand, on the left
As many cut the Skies: more hot's the fift.
So God dividing with an æquall hand,
Into so many parcells cuts the land.
The midst through heat affords no dwellers Ease:
The deepe snow wraps vp two: but betwixt these
And the other Regions, are two places set,
Where frosts are mixt with fires, and cold with heat.
But because this enumeration and description of the Zones set
downe by the Poets, seemes too popular and generall, we will
more specially diuide them according to the methode of our
times in this manner.

5 The Zones are either *Vntemperate*, or *Temperate*: the *Vntemperate* are againe twofold
either cold or hot.

6 The *Intemperate hot Zone* is the space con-

tained

tained betwixt the two *Tropicke* circles of
Cancer and *Capricorne*.

How vnaptly these names of *Temperate* & *Untemperate* agree to the Zones, considered in their owne nature, we shall speake in our second part: yet because I thought it unfit to vse other tearmes then the Ancients, I will not coine new names. This Zone, or space included betwixt the two *Tropicks*, circumscribes within it two great circles, whereof the one is the *Æquator* running iust in the midst neither inclining to the North or South: The other is the *Ecliptick* obliquely crossing it and meeting the two *Tropicks* twice in a yeare, in the *Spring* and *Autumne*. The extent or breadth of this Zone then is a quall to the distance betwixt these two *Tropicks*, to wit, 47 degrees, which make 2820 miles; because from the *Æquatour* to either *Tropicke* we account 23 degrees, which added and resolved into miles, will make the said summe: with in the compasse of this Zone are situate, the greatest part of *Africke*, especially that of the *Abyssines* (which common opinion with little probability, would haue to be the Empire of *Prester Iohn*) also many Ilands as *Iava*, *Summatra*, *Taprobana*, besides a great part of the South of *America* called *Pernana*: It was imagined by the Ancients, as *Aristotle*, *Pliny*, *Ptolomy*, and many other Philosophers, Poets, and Divines, that this Zone through extreame heat was altogether inhabitable: for which cause they called it *Intemperate*: The reason of this coniecture was drawne from the situation of this part in regard of that of the heauens. For lying in the middle part of the world, the Sunne must of necessity cast his rayes perpendicular, that is to say at Right Angles. Now according to the grounds of Peripateticke Philosophy the Idol of this age, the heat deriued from the Sunne, ariseth from the reflexion of the Sun-beames against the surface of the Earth. Wherefore the heat was there coniectured to be greatest, where the reflexion was found to be greatest. But the greatest reflexion, according to all Mathematicians, must be in this *Torrid Zone*, where the Sunne darts forth his Rayes at right Angles, which reflect backe vpon themselves. Which

false coniecture was a long time continued by the exuberant descriptions of Poets, and defect of Navigation: hauing as yet scarce passed her infancy. But how farre these surmises come short of truth, we shall declare in our second part, to which we haue reserued those Physicall and Historicall discourses concerning the qualities and properties of the Earth.

7 The Intemperat cold Zones are those which are included betwixt the Polar circles and the Poles: whereof the one is *Northerne*, contained in the *Arcticke* circle, the other *Southerne* in the *Antarcticke*.

These two Zones are not made out of the combination of two circles, as the former: but by one circle with relation to the Pole. The greatnesse and extent of this Zone is about 23 degrees and a halfe: which resolued into *Italian* miles will produce 1380. The *Northerne* cold Zone contains in it *Gro. n. land*, *Fineland*, and diuerse other *Northerne* Regions, whereof some are partly discouered, and set out in our ordinary Maps, other some not yet detected. For the other Zone vnder the *Antarcticke* Pole, it consists of the same greatnesse, as we know by the constitution of the Globe, hauing other such accidents correspondent as the *Northerne*, so farre forth as they respect the Heauens. For other matters, they lie hid in the vast Gulph of obscurity, this port hauing neuer yet (for ought I knowe) exposed her selfe to the discouery of the Christian world. Whether these two Zones be without habitation, by reason of intemperate cold, as the other hath beene thought by reason of too much heat, we shall in due place examine.

8 The Temperate Zone is the space contained betwixt the *Tropicke* and the *Polar* circle: whereof the one is *Northerne* contained betwixt the *Tropicke* of *Cancer* & the *Arcticke*

Arcticke circle: the other Southerne comprehended betwixt the Tropicke of *Capricorne* and the *Antarcticke* circle.

Why these Zones are tearmed Temperate, diuerse reasons are alleaged. 1 Because the Sun-beames here are cast obliquely on the surface of the earth, and by consequence cannot produce so much heat, as in those places where they are darted perpendicularly, if we only consider the constitution and site of the heauens: For as we shall hereafter proue, this may sometimes be altered by the disposition of some particular place. 2 It may be called the Temperate Zone, because it seemes mixt of both extreames partaking in some measure the both qualities of heat and cold: the one from the Torrid, the other from the Frigid Zones. 3 Because in these Zones the distances betwixt Summer and Winter are very remarkable, hauing a middle difference of time betwixt them, as compounded of both extreames. These temperate Zones included betwixt the Tropicks and the Polar circles are twofold as the circles: The northerne temperate Zone comprehended of the Tropick of *Cancer* and the *Arcticke* circle, contains in it the vpper and higher part of *Africke*, stretching euen to the mountaine *Atlas*. Moreover In it is placed all *Europe*, euen to the Northerne Islands in the *Arcticke* Zone, and a great part also of *Asia*: the other temperate Zone lying towards the South, is not so well knowne being farre distant from our habitation: and awaiting as yet the farther industry of our *English* and *Dutch* Nauigators. The breadth of this Zone, as the other contains about 43 degrees which is the distance betwixt the Tropicke and the Polar circle, which multiplied by 60, will bee resolved into 2580 Italian miles.

1 The Torrid Zone is the greatest of all: next are the two Temperate Zones: the cold Zones the least of all.

The Torrid Zone is found to be greatest as well in regard of longitude.

longitude as latitude, and is diuided by the Æquatour into two halves: the next are the Temperate; but the two cold Zones howsoever equall in Diameter to the Torrid, are notwithstanding least of all: where is to be noted that euery Zone is of the same latitude from North to South, beginne where we wil, because it is contained betwixt two equidistant circles: but all inioy not the same longitude from East to West. For the parts of euery Zone by how much neerer they are to the Æquatour, so much greater longitude will they haue: by how much neerer the Poles they are, so much the lesse longitude: forasmuch as the Parallels towards the Poles grow alwaies lesser and lesser. The inuention of the quantitie of the Zones before mentioned, may briefly thus be performed. The latitude of the torrid Zone is so much as the distance betwixt the Tropickes, which is Astronômically grounded on the greatest declination of the Sunne being doubled: This declination being by *Clavius* and others found to be 23 degrees 30 scrup. which being doubled will produce 47: which againe multiplied by 60, are resolued into miles, will amount to 2820: though the odde scruples of many Authors are neglected. The latitude of the cold Zones is also drawne from the greatest declination of the Sunne: For the distance of the Pole circles from the Pole it self is iust so much as the declination of the Ecliptick from the Æquatour, to wit, of 23 degrees 30 scrup. to which answer according to the former Rule 1410 *Italian* miles. The inuention of the latitude of the temperate Zones depends from the subtraction of the distance of the Poles of the Ecliptick, from the Æquatour: that is from the greatest declination of the Sun being doubled from the whole quadrant: in which subduction the residue will be 43, to which will answer 2580 *Italian* miles.

I *The Zone wherein any place is seated may be knowne either by the Globe or Geographical Table, or else by the Tables of Latitude.*

By the Globe or vniversall Mappe wee may knowe it by the diligent

diligent obseruation of the foure æquidistant circles. For if we finde it betwixt the two Tropicks, we may without doubt; thinke it to be in the Torrid Zone: If betwixt the Tropick circle and the Polar, it will be in the Temperate. If betwixt the Polar circle and the Pole it selfe, it must be in the cold zone. By the Tables of Latitude it may be found this waie: Seek the latitude of the places giuen in the Table, which if it be lesse then 23 degrees 30 scruples, the place is in the Torrid zone. If precisely it be so much in the Northerne Hemisphære, the place assigned is vnder the *Tropicke of Cancer*, which is the bound betwixt the *Torrid* and the beginning of the Northerne *Temperate* zones: But if it be in the Southerne Hemisphære, it will be vnder the Tropicke of *Capricorne*: which ends the *Torrid* zone, and beginnes the South Temperate zone: Every place hauing more Latitude then 23 degrees 30 scruples, yet lesse then 66 degrees 30 Minutes, is seated in the Temperat zone, either Northerne or Southerne as the places are in the Hemisphære. If the place be precisely of 66 Degrees 30 minuts, it will be iustly found to be vnder the Polar circle, either *Arctick* or *Antarctick*. Finally euery place whose Latitude exceeds the number of 66 degrees 30 minuts, is seated in the cold zone either Southerne or Northerne. If it reach iust to 90 degrees, it will be iust vnder the Pole it selfe.

9 Of the distinctiō of the Terrestrial spheare by Zones we haue spoken: we must in the next place deliuer the Distinction of the earth according to Climates.

10 A *Climate* is a space of Earth contained betwixt two *Parallels* distant from the *Æquatour* towards either Pole.

Climates are so called because of their *Declination* from the *Æquatour*; forasmuch as they are to be accounted as so many scales of ascents to or from the *Æquatour*. Some haue defined it from the ysc which is chiefly to distinguish the longest

time of the Artificiall daie: because at the point of euery climate truely taken, the longest day is varied halfe an houre: although this account agree not altogether with *Ptolomie*, and the ancient Geographers before him, as we shall shew hereafter. This distinction of the Terrestriall Spheare into *Climates* is somewhat a more subtile distinction then the former by zones; forasmuch as that is made by the combination of such Parallels as are principally named and of chiefe note, as the Tropicks and Polar circles. But this indifferently respects all without difference. The first beginning and measure, as well of this as all other measures of the earth is the *Æquatour*, for that which is most perfect and absolute in euery kinde ought to be the measure of all others. But yet we must vnderstand, that although we beginne our account of the *Climats* from the *æquatour*; yet the *Æquatour* it selfe makes no Climate, but only the Parallels which are therevnto correspondent. For as it is before shewed, vnder the *Æquatour* it selfe, the artificiall daies are all *æquall* in length, containing only twelue houres: wherefore beginning from the *Æquatour* betwixt that & the third Parallell, we count the first climate: from the third to the fixt, the second Climate: and so all the rest, making the number of the *Climates* double to the number of the Parallels; so that one and the selfe same Parallell, which is the end, and bound of one Climate is the beginning of the next; whence we see that to the constitution of euery Climate three Parallels concur, whereof two are extreame, comprehending the breadth of the said Climate, and one diuiding it, iust in the midst. A Parallell therefore differs from a Climate, as a part from the whole, being one circle correspondent to the *Æquatour*, whereas a Climate is a space contained in three Parallels. Secondly, as a Parallell is conceaued to adde to the artificiall day, one quarter or fourth part of an houre; so a Climate makes halfe an houre; so that by how much any Climate is distant from the *Æquatour*, by so many halfe houres the longest day, of that Climate goes beyond the longest daie of the place vnder the *Æquatour*. These *Climates* therefore cannot bee all of one *æquall* quantitie; because the *Æquatour* is a greater circle, and comprehends

comprehends the greatest space in the Earth: so that it must needs follow that these Climates neerer the Æquatour being made by the combination of greater circles are greater then those neerer the Poles. But because all Climates are made by the combination of Parallells; we are to vnderstand that there are three sort of Parallells to be knowne in *Cosmographie*: The first are those which doe distinguish the latitude of places, taking their beginning from the Æquatour; and are in an ordinarie Globe or Mappe distinguished, sometimes by 10, sometimes by 15 degrees. The second kinde of Parallells are those that make the zones, which are indeed some speciall named Parallells, as the Tropicks and the Polar circles: The third sort are called Artificiall Parallells; because they shew the distances of artificiall daies and nights, which are commonly noted in the margent of a Geographical Mappe, which last sort of Parallells are here chiefly to be vnderstood.

1 The Zones and Climates agree in forme but differ in greatnesse, number and office.

The Climates are so called (as we haue said) because they decline from the Æquatour, and are spaces of the Earth containing two Parallells, in which the longest day is varied by halfe an houre. These agree with the zones in some sort: for both of them are spread by the latitude of the Earth, and by Parallell circles compass it about as so many girdles: Nevertheless they differ one from the other. 1 In *Greatnesse*, because the zones are greater, the Climates lesser spaces in the Earth. 2 In *Number*, because there are only five zones, but many more climates. 3 In *Office*, vse and effect, because the zones are to distinguish the mutation of the quality of the aire and shadows according to diuerse Regions of the Earth; but the Climates are vsed to shew the greatest differences of houres in the day: to shew the variation of the rising and setting of the starres. for places vnder the same Climate haue the same quantity of daies and nights, the same rising and setting of the stars, whereas places seated vnder diuerse climats haue a great variation in the daies and nights, and a diuerse rising and setting of

the starres; for as often as the longest or Solstitiall day of one place, differs from the longest day of another by the space of halfe an houre, a new Climate is placed: wherefore vnder the Equatour or middle part of the earth the daies are alwaies æquall, to wit, of 12 houres: which beginning from the Equatour, if we approach towards either Pole, so farre as the greatest artificiall day amounts to. $12\frac{1}{2}$, wee may assure our selues that we are come to the first Climate: and so forward still the greatest day of our Climate will by so much exceed the greatest day of the other. As the Climates differ one from the other by halfe houres, so the Parallels by quarters, as we haue shewed: and shall more fully explaine in this Chapter.

2. The Climates compared one with the other, are not all of the same greatnesse.

Although the Climates are placed according to æquall increase of daies and nights, yet suffer they a great inæquality: For no climate is æquall to another in the same Hemisphere, but are still greater then other, by how much neerer they are to the Equinoctiall circle; for the latitude of the first Climate is reckned to be about 8. degrees, which make 480 *Italian* miles: but of the last not so many minuts as quarters. of miles.

I I In Terrestriall Climates, two things are to be vnderstood; 1 The *Invention*: 2 The *Distinction*. The *Invention* teacheth the manner how to finde out in what Climate any place lieth. The finding out of any climate depends vpon the obseruation of the length of the day; for the length of the day being once knowne, the Climate will also be found out by this Rule.

I Double the houres aboue 12, and the Product will shew the Climate. The

The reason of this rule is intimated before; to wit, that the climates are distinguished the one from the other by the space of halfe an houre of the longest day: Now the daies vnder the æquatour are alwaies æquall, containing 12 houres in length: from which towards the Pole they are increased by degrees: wherefore the number of the Climates must needs be double to the number of houres about 12: as for example, if I should finde out in what Climate *England* is situated: I find the length of the longest day to be about 18 houres, which is six houres more then 12; this I double, and it will bee 12; whence I collect, that *England* is situated vnder the 12 Climate: A more compendious way of finding out the Climate of any place, is by a certaine Table; wherein against every Eleuation of the Pole is set the iust Climate: which Table we shall insert hereafter. Here must be noted that this rule which wee haue taught is to be vnderstood of the Climates as they are absolute in nature, and not of *Ptolomyes* Climates: If any man would finde out the Climates of *Ptolomie*, hee must first cast away three quarters of an houre, which is 45 minuts; because his Climates, as we shall shew, beginne not immediatly from the Equatour, but from the latitude of 12 degrees.

12 Thus much for the *Invention*: the *Distinction* of Climates is into *Northerne* and *Southerne* Climates: both these againe are of two sorts, either proper or improper.

13 The proper Climates are those which are placed between the *Æquatour* and the point neere the *Polar circle*: The improper are those from the *Polar circle* to the Pole it selfe.

We must vnderstand that the Climates are considered two manner of waies, 1 Absolutely in respect of the whole *Terrestrial* Spheare. 2 Comparatiuely, in respect of the knowne ha-

habitable part of the Earth: According to the latter consideration the ancient Geographers haue otherwise distinguished the Climates then the new writers: whence ariseth a great difference and confusion amongst them, in defining the number of the Climates. For sometime they will haue a new Climat put whensoever the day increaseth a quarter of an houre: sometimes at halfe an houre, sometimes at difference of an whole houre or day. But the doubt is easily answered, and reconciled by our former distinction, for whereas they put the difference of Climates to be halfe an houre, it is to be vnderstood of these which are proper Climates betwixt the Equatour and the Polar circle; for it is certaine that beyond this circle the artificiall day increaseth, not only by houres, but by daies, weekes, and months; so that another account must be made of such Climates then of the former. But it hath beene generally taken for those Climates of the Ancients: now the distinction of Climates amongst the Ancients is of two sorts. The first was of the Geographers before *Ptolomie* who placed the vttermost bound Northward in the 25th degree of Latitude or Eleuation, & so made only seauen Climates. These 7 Climates were all vnderstood to be in the habitable parts wherein they were marked and designed out vnto vs by names taken from *Cities, Mountaines, Regions*, and such like remarkable places, where wee are to conceaue that climate as neere as may bee guessed to runne through the middle of any such Region, whereof it taketh its name: But the better to vnderstand the Distinction of the Climates, as well with the Ancient as Moderne Cosmographers, we will insert this following Theorem.

THEOREM I. *In the placing and Number of the Climates and Parallels, there is a great diversitie betwixt the Ancient and Moderne Geographers.*

This hath beene before mentioned: but for better distinction we haue reserued the handling of these differences to this proposition.

position, which may serue as a Corollary to the rest. First wee take it as granted that *Ptolomie* so appointed the Parallels (out of which the Climates must arise) that hee numbred 38 both waies from the Equatour: to wit, 38 towards the South, and so many towards the North. These Parallels he so distinguished, that 24 he numbred by quarters of houres, foure by halfe houres, foure by whole houres, & six by whole months. Hence is it that Geographers say, that a new Parallell is to be placed sometimes whereas the longest day increaseth by a quarter of an houre; sometimes where it increaseth by a halfe, sometimes by a whole houre, sometimes by a whole moneth. The first is to be vnderstood of those 24 Parallels which were deliuered by the Ancients before *Ptolomie*. The second, third, and fourth of such as were vnkknown vnto those Ancients before *Ptolomie*. To reduce all into order we will set down this distinction. The distinction of the Climates is either ancient or new. The Ancient was againe twofold: either former or later. The former was that which was set downe before *Ptolomies* time, wherein there were assigned 7 Climates according to the common opinion (though *Mercator* grants but 5) These Authors placed their Northerne bound in the 25 degree of elevation; The later distinction was almost the same; but somewhat corrected by *Ptolomie*, who placed 9 Climates towards the North. The first passed by *Meroe* a Citty of *Ethiopia*, where the longest or Solstitiall day is 13 houres. The second by *Siene* in *Egypt*, where the longest day is 13½: The third by *Alexandria* in *Egypt*, where the longest day is 14 houres, The 4th by the Island of *Rhodes*, where the longest day is of 14½. The fifth by *Rome*, where they haue the length of the longest day 15 houres. The sixth by *Pontus*, where the longest day is 15½ houres. The seauenth by the mouth of *Borisphenes* where the longest day is of 16 houres. Nevertheless some haue drawne the 6 Climate by *Borisphenes* in *Sarmatia*, and the seauenth by the *Riphaean* mountaies. *Ptolomie* to this number addes two more, and so reckons them that the 8 should passe by the *Riphaean* mountaines, and the 9 by *Denmarke* where the day at longest is 17 houres. To these Northerne Climates they

opposed.

opposed so many towards the South, which they called Anticlimates. These as it should seeme in *Ptolomies* time were Imaginary altogether, because few or no places were discovered at that time beyond the Line. But to leaue *Ptolomie* and his old Authors, and examine the industry of later Geographers, we shall finde the Distinction of the Climats to be twofold; either vnperfect wherein they numbred onely 19 Climats; or perfect, wherein they accounted 46 or 48, of which 23 or 24 were North:rne, and the other on the opposite part, to wit, in the South. The perfect distinction of the Climates is againe (as later writers speake) either certaine or vncertaine. The certaine they call that wherein the Climes are distinguished and ranged from the Equatour to the Polar circle: For sithens the Northerne Regions are now discovered beyoud 70 degrees of the *Elevation* of the Pole, and a Climate is defined to be a space comprehended betwixt three Parallels in the habitable Earth: wherein the length of the longest day is increased by halfe an houre; Therefore it must needs be, that from the Equatour to that habitable part of the Earth, wherein the longest day is 24 houres (which is not far from the Pole circle) there should be placed 24 Climats. The vncertaine distinction they call that which is betwixt the Polar circle, and the Pole it selfe, which may be tearmed *Improper*; because in these Climats the day is not increased by halfe houres, as in the former, but first by whole *Daies*, then by *Weekes*, and last of all by whole *Moneths*: Insomuch that vnder the Pole it selfe they haue 6 Moneths perpetuall day, and so long againe a continuall night. The *Parallels* whereof the Climats are made, were set downe by *Ptolomie* 38 (as we haue said) but the later writers haue placed them so farre Northerly, that they reach to that tract wherein the Sun tarires aboue the *Horizon* a whole 24 houres, and so haue numbred 23 or 24 towards the *North*, and so many towards the *South*. The cause of this diuersitie is because some drawe the first by the mouth of the *Redde-Sea*: others by *Meroe*: for the farther consideration of these climats corrected by later Geographers, they beginne their account from the Equatour it selfe, which in this case is the best rule of
certainty

certainly: because we hold that whole tract of Earth to be habitable, as we shall proue in our second booke.

14 A Parallell is a space wherein the longest day is increased by a quarter of an houre.

Concerning the *Parallels*, little can be said more then we haue opened in the doctrine of the *Climats*: for (as we shewed) the one cannot be well vnderstood without the other: onely to auoid ambiguity of speech, wee must consider that a Parallell may be taken either for a *Line* or *Circle*, in which sense we took it in the fifth Chapter; where we diuided them into *Named* or *Namelesse*: or else for a space bounded by circles as we here vnderstand it. The neglect of this distinction hath made some *Geographers* speake sometimes improperly. The Parallell is found out by this rule.

- 1** *Let the number of the longest day about 12 be multiplied by 4, and the Product will shew the Parallell.*

The reason is giuen before in the doctrine of the *Climates*, because the *Parallell* space, according to Latitude, is but halfe the *Climate*: so that as in finding out the Climate for any place we ought to double the houres of the longest day about 12: so here we ought to quadruple them, which is to multiply them by 4: As for example at *Rome* we finde the longest day to be about 15, which exceeds 12 by 3; which being againe multiplied by 4, will produce 12, which is the Parallell for the place.

- 2** *The Parallels no where diuide the Climats into two equall parts.*

In the *Climates* we are to consider two things, either their latitude or breadth from North to South: or their longitude or extent from East to West. In respect of the former wee may hardly without sensible error call the Parallell halfe the Climate, in regard the three lines whereof the Climate consists, to wit, the middle and the two extreames, are not alwaies of like distance: but if we consider the extent of the Circumference as

it stretcheth it selfe betwixt East and West, we must needs acknowledge much more: to wit, that of two *Parallels*, diuiding the same climate betwixt them, that that is manifestly the greatest which is next the *Æquator*, and that is the least which is neereft to the *Pole*: because the Circles which comprehend their *Parallel* spaces, continually decrease towards the *Pole*: so that if we imagine two men to travel round about the earth the one in a *Parallel* neerer the *Æquatour*, the other neerer the *Pole*, in the same space of time; it must needs follow that hee should goe farre faster which is neerer the *Æquatour* then the other neere the *Pole*: for howsoeuer *Columella* seemes to make a *Parallel* to haue in breadth 60 foot, and to intimate by consequence an æqualitie of the *Parallels* amongst themselves, yet must this be vnderstood of *Parallels* which are neere one to the other neere the *Æquatour*, which comprehend a great space of land, and admit no sensible difference. Other matters which concerne the *Climates* and *Parallels*, shall be (God willing) vnfolded in our Tables in the next Chapter, when wee haue spoken of the *Inhabitants*, and such other adiuncts appertaining: without the which this treatise will be vnperfect, depending for a great part on such circumstances as our method admits not in this place, but immediatly follow.

CHAP. X.

Of the distinction of the Inhabitants of the Terrestriall Spheare.

I **H**Auing hitherto treated of the distinction of spaces bounded by circles in the Terrestriall Globe, to wit, *Zones*, *Climates*,

mates, and Parallels; we are now to create of the Inhabitants, as such adiuncts as properly belong to such spaces; so farre as it concernes the constitution of the whole Spheare.

- 2 The distinction of the Inhabitants is twofold, either *Absolute* or *Comparatiue*: Absolute as they may bee considered in themselves without any comparison of one with the other.
- 3 The former is againe twofold: either from the *Position* of the Spheare, or the differences of their *Sun-Shadowes*: According to the position of the Spheare the Inhabitants may be said to haue either a *Right, Oblique,* or *Parallell* Spheare according to their Horizons.

What these three Spheares are, may appeare by that which we haue formerly spoken concerning the distinction of Horizons in the sixt Chapter of this Treatise, and therefore needs no farther repetition: we are in this place to treat of the seuerall accidents, and conditions of the Inhabitants. Out of the distinction of the threefold Spheare will arise 13 manners of habitation: which for more order sake, wee will reduce into certaine heads in this manner.

- 4 The people of a right Spheare are such as inioy a right Horizon, whose proprieties shall be declared in this Theoreme.

1 *The Inhabitants of a Right Sphære in respect of the heauens haue the same accidents.*

These accidents are chiefly foure; 1 They enioy a perpetuall Equinoctiall, hauing their daies and nights alwaies equall the one to the other: because the sunne neuer swauing from his *Eclipticke*, hath his course equally diuided by the *Horizon*. 2 With the all the stars equally set & rise; because all the Parallels wherein the starres make their Diurnall Revolution are equally cut by the *Horizon*. 3 To them the Sunne is twice in the yeare verticall, that is directly ouer their heads, and twice againe in the yeare Solstitiall: The former in the first degrees of *Aries* and *Libra*, the latter in the first degrees of *Cancer* and *Capricorne*: which diuerse positions of the Sunne, some later Geographers haue tearmed foure Solstices: two higher and two lower. 4 Hence comes it to passe that they yearly enioy two winters, and two Summers: likewise two springs & two Autumnes. Their Summer when the Sunne is to them verticall: their winter when it is seated in either of the Tropickes. Their Springs & Autumnes while the Sun is passing through the middle spaces betwixt both.

5 The people inhabiting an *Oblique Sphære* are such whose *Horizon* is oblique. The proprieties belonging vnto them are either Generall or Speciall.

6 The Generall are such as agree to all those which inhabit an oblique Sphære.

1 *All the Inhabitants of an oblique Sphære agree in two proprieties.*

These two proprieties wherein they agree are these. 1 To all the Inhabitants without the Equatour vnder what Parallell soeuer, the daies are equall to the nights only twice in a yeare, to wit, either in the beginning of the Spring, or the beginning

of

of the Autumne. At other times either the daies increase above the nights as in the Summer, or grow lesser as in the winter. 2 To these inhabitants some starres are perpetually seene, as such which are neere the Pole to which they incline: some are never seene, as such as are farthest off from the said Pole: some rise and set, which are those which are in the middle space betwixt both; which are sometimes visible, and sometime hid.

7 The speciall Accidents of an Oblique Horizon, are such as agree to speciall places in the same Spheare.

1 *The Inhabitants of an Oblique Spheare are of five sorts, inioying so many correspondent properties.*

The first sort are of those, whose Zenith is betwixt the *Aequator* and one of the *Tropicke*s, even vnto the 23. Degrees, 30. Scruples of eleuation of the Pole: In such a sort, towards the North betwixt the Line and the Tropicke of *Cancer*, are placed the inhabitants of *Zeilan*, the extreame part of the *East Indies*, *Hispaniola*, *Guinea*, *Nubia*, with some part of *Arabia felix*, and all other places betwixt the *Aequator* and the Tropicke of *Cancer* in the *Torride Zone*. Towards the South in the same Latitude, are placed the *Brasilians*, the *Peruvians*, the *Tanians*, with many others. The Accidents which happen vnto these Nations are these, 1. They may see all the starres except a few which are neere the Pole. 2. Their dayes and nights are somewhat vnæquall, so that their longest day, or longest night, is not alway of the same quantity. 3. Twice in the yeare they haue the Sunne verticall, but without the *Aequator*. 4. They haue two Summers, and two Winters, but not æqually tempered. 5. The length of their longest day reacheth to 13. ½ houres.

The second sort are such as inhabite vnder the *Tropicke* itselfe, whose eleuation of the Pole is æquall to the greatest declination

clination of the Sunne, which is 23. degrees, 30. Scruples. Vnder the Tropicke of *Cancer* is placed a great part of *Arabia felix*, *East India*, the Southerne parts of *China*, the higher parts of *Egypt*, and *Siene*. Vnder the Tropicke of *Capricorne* are placed the people of *Monomotapa*, and *Madagascar*, with other places: The accidents belonging vnto them are these, 1. To them appeare all the starres comprehended in one of the Circles, but none of the other. As for example, to those inhabiting the Tropicke of *Cancer*, the starres included within the Articke Circle alwayes appeare, but neuer those which are in the Antarticke: likewise to those which dwell vnder the Tropicke of *Capricorne*, all the starres appeare which are contained within the Antarticke Circle, but none of those included within the Articke Circle. 2. By how much nearer the Sun approacheth to their Zenith or Verticall point, by so much are their dayes lengthened; and by how much farther it goes off, by so much are they shortned: so that they inioy then their longest day, when the Sunne directly passeth by their Zenith. 3. To them the Sunne is verticall but once in the yeere: to wit, to those vnder the Tropicke of *Cancer*, when the Sunne enters into the signe; as to the other when it toucheth the first Degree of *Capricorne*. 4. They haue but one Summer and one Winter throughout the yeare.

The third sort, are such inhabitants as dwell in one of the temperate Zones betwixt the Tropicke and the Polar Circles from 24. Degrees of eleuation, to 66. Degrees, 30. Scruples. Such inhabitants towards the North, are (as we haue shewed) almost all the inhabitants of *Europe*, *Asia maior*, and part of *Africa*: as on the other side towards the South, the *Chylienses*, the farthermost *Africans*; and those that dwell neere the straits of *Magellane*. Their properties are chiefly these, 1. Many starres are by them alwayes seene, and many neuer appeare. 2. Their dayes notably differ in the qualitie. 3. The Sunne neuer arriveth at their Zenith, but is alwayes on the South of those which inhabite betwixt the Tropicke of *Cancer*, and the Articke Circle, and alwayes on the North side of such as dwell in the opposite temperate Zone. 4. They haue in the
yeare

yeare but one Summer and Winter, but by reason of the diuerſitie of places much vnæquall: for where the eleuation of the Pole is greater, the winter is much harder; but where it is leſſer it is more temperate.

The fourth kinde of inhabitants, are thoſe which reſide vnder the Polar Circle, (which is their Zenith) where the temperate Zone endes, and the cold beginnes: where the eleuation of the Pole is beyond 66. Degrees 30. Minutes, in which Tract lies *Noua Zembla*, with many other Hands not yet well diſcouered in the North: and perhaps as many more vnder the Antarticke Circle towards the South, leſſe knowne than the other. The accidents belonging to them are theſe, 1. Thoſe which inhabite vnder the Arcticke Circle, ſee all the ſtarres included within the Tropicke of *Cancer*, but neuer thoſe within the Tropicke of *Capricorne*: Likewise, thoſe which liue vnder the Antarticke Circle, ſee all the ſtarres within the Tropicke of *Capricorne*, but neuer thoſe within the other Tropicke of *Cancer*. 2. Their longeſt day at Midſummer is 24. houres, their night then being but a moment: likewise their longeſt night, as at Mid-winter, is but 24. houres, their day paſſing not a moment. 3. The Center of the Sunne every yeare twice toucheth at their Horizon. 4. The Sunne at Noonetide is alwayes on the South of thoſe which dwell vnder the Arcticke Circle, except it be in the Summer Tropicke, when it is the Mid-night, or Northerne point: likewise to thoſe that are vnder the Antarticke Circle, the Sunne at noone is alwayes on the North ſide, except vnder the Winter Tropicke. 5. They haue in the yeare one Winter and one Summer: but the Winter farre colder, and the Summer ſlacker then in the forenamed places.

The fiſt and laſt habitation, is of thoſe which are included betwixt the Polar Circle, and the Pole it ſelfe, from 66. Degrees and 30. minutes of eleuation to 90. In which Tract little is diſcouered Northward, and in the South climate nothing at all. The ſpeciall Accidents appertaining to them are theſe, 1. With them a few ſtarres are ſcene to ſet and riſe. 2. They haue an *Equinoxe* the Sunne touching the fiſt De-

gree

gree of *Aries* and *Libra*. 3. They of the North Zone haue more dayes about the middle of Summer, and more nights in the Winter: likewise, they of the South frozen Zone, the contrary. 4. They haue extreame cold Winters, and in stead of Summer, a small remission of cold. 5. The signes of the Zodiacke to them preposterously rise.

8 The inhabitants of a *Parallell Spheare* are discouered in this proposition.

1 *The inhabitants of a Parallell Spheare enioy but one kinde of habitation, in respect of the Heauens.*

A *Parallell Spheare* I here accurately vnderstand for that posture of the Globe, wherein the Pole of the world is precisely placed in the Zenith, or eleuated to 90. degrees of Altitude: because onely in such a site, the Equator and the Horizon agree in one, and lie parallell to all the rest of the Parallell Circles: which places, whether it be at all capable of habitation by reason of cold, we shall discusse hereafter in the second part: but out of supposition admitting a place of habitation, these accidents will happen, 1. The fixt starres which they see, are alwayes scene so, that with them there is no point of East or West; for the starres neuer rise nor set. But the Planets rise and set, but not by their diurnall, but proper motion. 2. They haue a continuall day of sixe moneths, and a night also as long, the Sunne rising continually in the first degree of *Aries*, and setting in the first of *Libra*. 3. The sun in the Equinoctiall points, for all the time that he is about the Horizon (as all the other starres) is turned round about in manner of a wheele. 4. The Equator serues in place of the Horizon, and the Equator is euery while equidistant from the Pole. 5. They haue one Winter and one Summer, the former exceeding cold, the latter lesse warme then ours.

9 The second distinction of the inhabitants of

of the earth is taken from their *Noone shadows*.

The Sunne in diuers parts of the earth diuersly spreads his shaddow, because the *Gnomons* or *Opacous* bodies by which the shadows are made in the earth, are in diuers places diuersly opposed, or objected to the Sunne: for whereas the Sunne so runnes in his *Eclipticke* Circle betwixt the two Poles, that though his passage be in an oblique Circle, yet he neuer comes so farre as the Poles themselves: it necessarily must be, that sometimes he should shoot forth his beames *perpendicularly*, as when it is in the verticall point of a place; sometimes *Obliquely*, as when he declines either one way or other from the verticall point; sometimes in *parallell* wise, forasmuch as in some places of the earth, the Sunne cleauing as it were to the Horizon, casts out his beames *parallell* and *equidistant* to the plaine of the Horizon. The right or perpendicular beames of the Sunne, falling on the superficies of the earth at right Angles, are turned and reflected into themselves, and so make no shaddowes at all. But the oblique beames, in that they are not reflected into themselves, must of necessity produce shaddowes, yet in diuers manners; for those Sun-beames which obliquely proiect themselves on the plaine of the earth, so as they come not from the Horizon it selfe, will make such kinde of shaddowes as shall proportionally agree with their *Gnomons*, or *Opacous* bodies, and such whose magnitude may in a manner be designed out, and certainly measured by the sight. But on the contrary part, the beames which are esteemed *parallell* to the plaine of the Horizon, finding no solide obstacle or let, shoot forth infinitely, making no Angels on the superficies of the earth, and can haue no proportion at all with their *Gnomons*, that the shadow may be any way designed by our eyes. But here we are to consider, that the shaddowes chiefly to be considered, are the *Meridian* or *Noone-shaddowes*, which take their distinction from the diuers incidence of the beames, which the Sun casts forth at noone. According to this manner,

10 The inhabitants of a place in respect of the shaddowes, are either *Amphis- cij*, *Heteroscij*, or *Periscij*. The *Amphis- cij* are those, whose *Noone-shaddowes* (but at diuers times of the yeare) are cast both wayes ; that is to say, North and South,

Amphis- cij signifies as much as people of a double shaddow: such are they which inhabite betwixt the *Æquator* and the *Tropicke*, where the eleuation of the Pole equals not 24. degrees : These men haue the Sunne twice euery yeare in their Zenith or verticall point, and then they make no shaddowes at all ; and therefore they are called *As- cij*, or without shad- dows. But when the Sunne passeth from their verticall point towards the Northerne signes, then at noone it will cast the shaddow towards the Southerne coast : But contrary wise, comming from the Zenith toward the Southerne signes, the shaddow will be darted toward the North, which is euident out of the *Opticke* principles ; because the shaddow is alwaies found to be opposite in place to the *Sun-beames*, the *Gnomon*, or darke body interposed.

11 The *Heteroscij* are those, whose *Noone- shaddowes* turne onely one way : that is, either toward the North, or toward the South.

These Nations inhabite in a temperate Zone, betwixt the *Tropicke* and the *Polar Circles*, whereas such as dwell in the temperate toward the North, betwixt the *Tropicke* of *Cancer*, and the *Polar Circle* *Articke*, haue their noone-shaddowes cast Northward. But those on the other side of the *Æquator*, dwelling betwixt the *Tropicke* of *Capricorne*, and the *Antarlike* Circle, cast their shaddowes Southward : Of the for- mer

mer sort are *Grecians, Italians, French, Spaniards, Germans, Polonians, Suedians, Danes, English*, and the rest inhabiting our temperate Zone: which gaue occasion of that speech of *Lucan* the Poet, concerning the *Arabians* comming into *Thessaly*, in the warre of *Hanniball* and *Pompey*;

*Ignotum vobis Arabes venistis in orbem,
Umbras mirati nemorum non ire sinistras.*

Y^e are come *Arabians* to an vnknowne land,

Wondering the shades nere take the Southward hand.

Which verses are in this sense to be vnderstood; *Poets* are said to looke and turne their faces towards the West, so that the South must of necessitie be counted the left side: Now the place whereunto the *Arabians* came, being a part of *Thessaly*, where such dwell who onely cast their shaddowes one way, to wit, Northward; but *Arabia* their naturall Countrey, being supposed to be included in the *Torrid* Zone, where the shaddowes were said to be cast both wayes, they are said to wonder: The reason why our shaddowes at noone are cast alwayes toward the North, and the others toward the South, is related before, to be because the shadow doth alwayes occupie or possesse the place opposite to the Sunne, or light body.

12 The *Periscij* are such inhabitants whose shaddowes are mooued round about them in a circular forme.

In some places of the earth the *Noone-shaddowes* take not their beginning from our heads, but of one side, and are extended forward to the plaine of the terrestriall Horizon, and so mooued round about the Opacous body, as about a *Gnomon*: whence they are called *Periscij*; which is as much to say, as men hauing shaddowes mooued round about; such is their habitation which are included in the *Frigide* Zone, circumscribed within the Polar circles, and the Poles: Here the Sunne neuer directly passeth by the crowne of their heads, but at one side: so that they haue the Pole for their verticall point, but

the *Æquatour*, as it were, for their *Horizon*. These *Periscij* are of two sorts, for some are contained in the *Arcticke* circle, the other in the *Antarcticke*, whereof both are as yet vndiscovered; especially the *Antarcticke*, being farthest off from our climate.

- I *The habitation of the Amphiſcij comprehends 7. Parallels, of the Heteroſcij 41. of the Periſcij 6. Moneths.*

Of the nature and accidents of these three sorts of people there needes no more to be spoken, then we haue deliuered before in this Chapter: Neuertheleſſe, for a recapitulation of our former doctrine in this and the precedent Chapter, it will not be amiſſe to infer this Table of Climates, set out by our exactest *Geographers*; wherein is expreſſed (as it were) to our view the reſpect and ſeueral accidents, which belong to these ſeueral inhabitants.

- 13 Thus much for the Inhabitants absolutely conſidered: The inhabitants compared one with the other according to their poſition, are the *Periæci*, *Antæci*, and *Antipodes*.

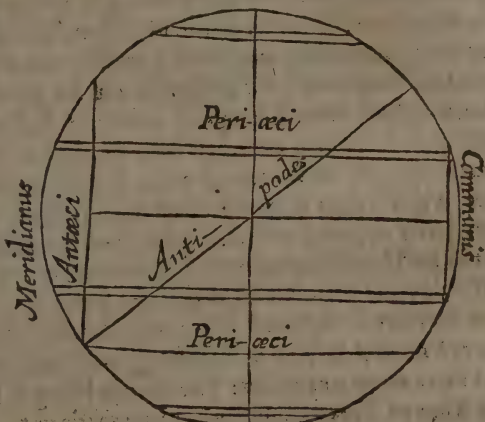
- 14 The *Periæci* are thoſe inhabitants which dwell in the two oppoſite points of the *Parallell* circle.

- 15 The *Antæci* are ſuch as dwell vnder the ſame *Meridian*, but in diuers *Parallels* æqually diſtant from the *Æquatour*.

- 16 The *Antipodes* are ſuch as inhabite vnder one *Meridian*, but vnder two *Parallels* æquidistant from the *Æquatour*, and two oppoſite points of thoſe *Parallels*. These

These names being originally Greeke are taken from the diverse manner of dwelling of one nation in respect of another. The *Periæci* are called such as dwell (as it were) about the Hemisphære in the same Parallell in two opposite points: the one in regard of the other being *Easterne*, the other *Westerne*: so that they are supposed to differ the one frō the other 180 degrees which is the semicircle:

Polus Arcticus



Polus Antarcticus

are to be accounted rather Antipodes, although (for ought I see) the name might agree. The *Antæci* (as the name imports) are such as dwell one against another, having one self-same Meridian and a quall distance from the Equatour, the one in the Northerne, the other in the Southerne Hemisphære. The *Antipodes* (otherwise called *Antichethones*) may popularly be described to be such as dwell feet to feet one against the other: so that a right line being drawne from one side to the other, will passe by the Center of the world: whence they precisely are distant the one from the other 1800 in a greater circle: wherein they are distinguished from the *Periæci*, which are divided by the degrees of a lesser circle: such compared one to the other are the *Americans* and the *Easterne Indians* about the river *Ganges*; the Inhabitants of *Pern* and *Calesute*; those of *Peria* &c.

Summatra to *England* I finde no other Antipodes but the Sea, or at least some parcell of land in the South continent neere *Pstacorum Regio*: Here is to be noted that the former definition of *Antipodes* given by the ancients, was only to be understood of the knowne habitable part of the Earth; because such as dwell directly vnder the *Aquatour*, or either of the *Poles*, although they may be Antipodes agree not to that definition: by reason the former are Antipodes only in opposite points of the *Aquatour*: the other of the Meridian. Whether there were any Antipodes or no, was made a question amongst the Ancients, insomuch that Saint *Augustine* in his booke *de civitate Dei*, and *Lactantius* in his third booke of *Institutions*, seemes stiffely to defend the contrary: which opinion is supposed to growe out of their contempt or neglect of *Mathematicall* studies, in those ages wherein the zeale to religion was most vnnecessarily opposed to Philosophie, and the mistresse forsaken of her best hand-maides: which ignorance of the Ancients was so far deriued to posterity, that in the yeare of our Sauior 745, one *Boniface* Bishop of *Mens*, was accused before Pope *Zachary* *Virgilius* Bishop of *Salisbury*, for heresie, in that he averred there were Antipodes: The matter being first preferred to the King of *Bohemia*, and an appeale made vnto the Pope, it happened that the honest Bishop for this assertion, was flatly condemned for hæreticall doctrine, and inforced to recant his opinion: yet is it wonderfull how such matters were thus decided: for granting these two easie grounds, First that the earth is *Spherical*, a proposition proued in their time; 2 That euery place, or at least two opposite places in the Terrestrial Spheare may be habitable; it must of necessity follow, that such Antipodes must be granted: which makes me to imagine that Saint *Augustine* absolutely and grossely denied not the *Antipodes*; because in setting downe the premisses and grounds of our opinion, he seemed to vnderstand them too well to deny a necessary induction, being a man of so great a wit and apprehension: but questionlesse he thought that the Torrid Zone, which by most of the Ancients in his time, was reputed vnhabitable and vnpassable, no man had yet set his foot in those remote parts

parts beyond the line: so that it seemed in him not to arise out of ignorance of the constitution of the earthly Globe: but out of the received opinion of the Torrid Zone, and the vast Ocean: the one of which he held vnhabitable, the other vnpassable: from whence also sprang vp an argument, or rather an idle fancy, that the Antipodes could not be admitted without granting another Saviour, and another kinde of men besides *Adams* posterity: for if this coniecture had not taken place, the Pope (I suppose) would neuer haue proued himselfe so ridiculous a Iudge, as to haue condemned *Virgilius* for hæresie. As for *Lactantius* (howsoever otherwise a pious eloquent Father) the weaknesse and childishnesse of his arguments, will to any indifferent reader discouer his ignorance in the very first rudiments of Cosmographie. Here we may learne how farre religion it selfe is wronged by such who set her opposite to all her seruants. But whatsoeuer the Ancients out of their glimring reason haue coniectured, our times haue sufficiently decided this controuersie; wherein such Antipodes are established both by reason and experience: which matter we shall reserue to our second booke; wherein we shall declare how farre, and in what sense the Earth may be tearmed habitable.

1. *Those which are to vs Pericœci, are the Antœci to our Antipodes: our Antœci the Pericœci to our Antipodes: likewise our Pericœci are the Antipodes to our Antœci.*

This Proposition as a Corollary may by necessary consequence be deduced out of the precedent definition, and be well expressed out of the constitution of the artificiall Globe, and needs no farther demonstration.

2. *The Pericœci, Antœci, and Antipodes are diuersly distinguished in respect of the celestiall apparences.*

The proprieties of the *Pericœci* are chiefly foure. 1 They haue the same eleuation of the Pole, and therefore the same temper

of the year, and the same length of daies and nights. 2 They dwell East and West in regard one of the other. 3 They haue contrary times of daies and nights: for when the one hath his Noone, the other inioyes his mid-night: likewise when the sun with the one riseth, it setteth with the other. 4 They haue the same Zone, Climate, and Parallell; but differ by a semicircle, to wit, 180 degrees. To the *Antæci* they haue likewise assigned 5 proprieties. viz. 1 They inhabite the like Zones, but in diuerse Hemispheres. 2 They haue the same eleuation of the Pole, but not of the same Pole: because the one sees the Pole *Arctick*, the other the Pole *Antarctick* equally raised aboue his *Horizon*. 3 They haue Noone and Mid-night iust at the same times. 4 They inioy the same temper of the Heauens. 5 They haue the seasons of the year contrary. For when the Southerne *Antæci* haue their Summer, the Northerne haue their winter; and contrariwise: when the Northerne, haue their Spring, these haue their Autumne. To the *Antipodes* they haue allotted 3 Proprieties. 1 That they haue the same eleuation of the Pole, though not of the same Pole. 2 They haue the same temper of the year, and the same quantity of daies and nights. 3 They haue all the other accidents contrary: For when the one hath Night the other hath Day, when one Winter, the other Summer; when the one the Spring, the other Autumne; and contrariwise. These accidents and proprieties here mentioned, must be vnderstood in respect of the Heauens only. The qualities arising from diuerse other Accidentall and particular causes in diuerse places of the Earth, we shall differre vnto our second part.

C H A P. XI.

Of the Longitudes and Latitudes.

1 **T**He distinction of the Terrestriall Globe according to certaine *Spaces*, being formerly explained, wee are now to treat of the Distinction of the said Spheare according to certaine *Distances*.

2 A Distance here we vnderstand to be a direct line drawne betwixt two points in the Earth: such a Distance is tvvofold, either *Simple* or *Comparatiue*.

3 The Simple Distance is taken from the tvvo great circles: to vvith, the *Meridian*, or the *Æquatour*: vvhich is either the *Longitude* or *Latitude*.

The diuision of *Distances* into the *Simple* or *Comparatiue*, is most necessary: for it is one thing for a place absolutely taken in it selfe, to bee distant from some fixt point or other in the Globe: Another for two places to be compared betwixt themselves in regard of such a fixt point: Forasmuch as the former implies only the distance betwixt two points, the other the distance of two such points or places in respect of the third. These points, from which such points are said to be distant, are either found in the Meridian Circle, from which the Distance is called Longitude; or else in the *Æquatour*, whence wee call it Latitude.

4 The Longitude is the distance of any place Eastward from the first Meridian.

To vnderstand the better the Longitude, we must consider that it may be taken two waies: either *Generally*, or *Specially*: In the former sense it is taken for the Distance of the whole Earth, stretched from the West vnto the East, and contrariwise from East to West. The bounds or limits of this Longitude were by *Ptolomie* and the ancient Cosmographers set no farther distant then the halfe circle, continuing 180 degrees; because the rest of the Earth lay at that time vndiscovered. The end of this space towards the East, was the kingdome of *China*, at the furthest part of all *India*, distant, as wee said, from the *Fortunate Ilands* where *Ptolomie* placed the first Meridian, 180 degrees: which being taken in the Meridian, and resolved into Miles, according to our former rules, will giue 10800 *Italian* miles: but this space delineated out by the Ancients, was very scant and narrow in respect of the other parts since found out, being added to the former. For beyond the bound set by *Ptolomie* in the East, it is manifest that 60 degrees are found out, and made knowne. An example whereof we haue in *Scythia* without the mountaine *Emaus*, which is knowne to extend it selfe 60 degrees Eastward towards the kingdome of *Cathay*, discovered by the *Portugalls*: so that the breadth of the Earth Eastward is fully knowne so far as 240 degrees, which being measured in the Equatour will amount vnto 14400 miles. Moreover towards the West, beyond the *Fortunate Ilands*, it is knowne to stretch to the farthest border of *America*; so that 340 degrees of the earth is fully detected, if not all the rest being only 20 degrees, which are only deficient to make vp the whole circle. Which we may the sooner credit; because our times haue brought forth (for ought any Authors haue related) the most excellent Navigators of all ages; which haue sailed the vast Globe of the Earth round about, and leaue behinde them a foundation, whereon others might easily build. But to let passe the Generall Longitude of the Earth betwixt the East and the West; Wee must vnderstand that the Longitude here mentioned

mentioned is to be taken in a more speciall sense, for the Distance of any place from the first Meridian, being placed either in the *Cannier*, as the Ancients would haue it, or in one of the *Azores* according to the latter Geographers. This then must be the bound from whence we must beginne our account; The subiect wherein the number of degrees may be taken, may bee the *Equatour* or *Parallell*. Whence by some the Longitude of a place is defined to be an Arch of the *Equatour* or *Parallell* intercepted betwixt the first Meridian and the verticall point of the place proposed: so that by necessary consequence, such places as are subiect to the same Meridian, in the same Hemisphere, Easterne or Westerne, haue the same Longitude, which is the distance from the point of the West: but places declining more towards the East haue the greater Longitude; but nearer to the West, lesse.

1 *Places inioying the same Longitude are not alwaies equally distant from the first Meridian: and contrarywise places equidistant from the first Meridian haue not alwaies the same Longitude.*

The reason is evident out of that which hath beene often spoken before: because the degree of a greater circle are greater, of a lesse lesse, according to the greatnesse of the circle. Now the Longitude of a place measured in the *Equatour*, will answer to 60 *Italian* miles: but in other *Parallells* lesse.

2 *The difference of Longitudes begets the difference of Times: Those therefore which exactly are subiect to the same Longitude, haue their Noone at the same moment: but where the Longitudes are different, the Noonetides are also different.*

That the difference of time is varied according to the difference of Longitude in diuerse parts of the Earth, is a matter obuius to euery mans vnderstanding, out of two premised grounds. 1 That the Earth is Sphericall. 2 That the Sunne in his Diurnall course once in 24 houres compasseth it round: whence it comes to passe that places situate *Eastward*, see the Sunne sooner then those which are placed in the West, & that with a proportionall difference of time; that to euery houre in the Sunnes motion is assigned a certaine number of correspondent miles: which is in some sort expressed in a Geographickall Globe or Map, wherein we shall finde described 12 Meridians, which diuide the whole compasse of the earthly Spheare into 24 æquall parts; in such sort that betwixt each of the two neereft Meridians, are reckned 15 degrees, which make one houre: by which we may more easily vnderstand how soone the Noone-time happens in one Citty before another: for if one Citty stands Eastward from another the space, of three of those fore said Meridians, it is euidēt that it will inioy noone three houres before the other. The reason of this difference of times, is the difference of Longitudes, wherein to euery houre the Cosmographers haue allotted 15 degrees in the Sunnes Diurnall motion: so that 15 degrees multiplied by 24 houres, which is the whole naturall day, there will be produced 360 which is the number of degrees in the whole circle.

- 3 *If two men from the same place travell, the one Eastward, the other Westward round about the Earth, and meet in the same place againe: they shall finde that hee which hath gone Eastward hath gotten, and the other going Westward hath lost a day in their account*

This is without difficulty to be vnderstood, out of the change of Longitudes, seconded by their trauell, varying perperually the quantity of the day: for it is manifest, that he who from any place assigned saileth Eastward, mouing continually against the

the motion of the Sunne, will shorten somewhat of his day; taking away so much from it, as his iourney in proportion of distance, hath opposed and anticipated in the time the Diurnall course of the Sun: so that daily gaining something from the length of the day, which must be elsewhere recompenced. It must needs be, that in the whole circute of the earth, it will amount to 24. houres, correspondent to the whole circuite of the Sunne, and the compasse of the earth, which will make another day: Likewise, if we suppose another in compassing about the earth, to goe Westward, it cannot be otherwise imagined, but that seconding the course of the Sun, by his owne iourney; he will daily adde somewhat to the length of his day, answerable to his distance, from the place wherein he began to follow the Sunne in his course from East to West. The daily addition to the length of the day, proportionall to the longitudes which he changeth, (the Sunne running a like courte) must daily diminish somewhat of the Diurnall course of the Sunne, and so at his iourneys end, which was supposed to be the whole circuite of the earth, answerable to 24. houres in the Sunnes course, it will loose a whole day. To demonstrate both these cases, we will imagine in supposition, that of these two trauallers going the one Eastward, the other Westward, the former should take away from the length of the day, or the latter adde to it for euery 15. miles one minute. Then by the golden Rule, if 15. miles either substract or adde one minute in the length of the day, must 21600. miles, which is the whole compasse of the earth, according to the same proportion, either substract or adde 1440 minutes, which make 24. houres, the length of the naturall day. To confirme the demonstration by popular experience, I remember I haue read in the *Hollanders* discovery of *Frētum de Mayre*, that conuining home into their owne Countrey, they found by comparing their accounts with their countrymens at home, they had lost one day, hauing gone Westward, & so compassed the earth round. Hence will arise diuers conjectaries not vnplesing to be scann'd. One I will touch not much dissonant from our purpose; *That three men residing*

in the same place at one time, shall notwithstanding all vary one from the other in the dayes of the weeke, keeping yet an exact account: which to explaine the better, we will suppose a *Jew*, a *Sarazen*, and a *Christian*, residing in the same towne together: It may so happen according to our former grounds, that the *Sarazen* according to the Law of *Mahomet*, shall obserue his Friday, the *Jew* his Saturday, being his Sabbath; and the *Christian* the Lords day, being the Sunday: yet so, as all shall happen on the same day: all of them excluding any error in their calculation. For supposition sake, we will place them all at one time all together in *Palestine* on a Saturday; at which time, let vs imagine the *Sarazen* to take his iourney Westward, the *Christian* Eastward, so as both of them in their coasts compasse the world, to meet againe in the same place: The *Jew* all the while we suppose resident in the same place: it will follow by necessary consequence, that the *Sarazen* going about the earth Eastward, will loose one day; the *Christian* iourneying Westward, will gaine one day: the *Jew* remaining in the same place, will neither gaine nor loose. These three men then, meeting together againe after a yeare, two, or three, at the same place, must needs make a diuers account; for one and the selfe-same day, will be to the *Sarazen* Friday, to the *Jew* Saturday, and to the *Christian* Sunday, if they exactly calculate the time from their first meeting, to their returne vnto the same place. Me thinkes this, if there wanted other Arguments, were a reason sufficient to conuince some strait-laced men, who rigidly contend our Lords day (which they erroneously tearme the Sabbath) to be merely morall, as grounded on the Law of nature. If it were so, according to our premises before demonstrated, this absurditie would ensue necessarily: That the Morall Law, which they call also in a sort the Law of nature, is subiect to manifold mutation, which by our best Diuines is vtterly denied. The consequence will easily follow, because it cannot be denied by any Christian, But that all nations of the world issued from *Noahs* Arke, the Seminary of mankind, and spread themselves from thence ouer the face of the whole earth, some farther, some at a shorter

ter distance: whereby changing the longitude with their habitation, they must of necessity alter the differences of times, whereon they seeke to ground their Sabbath. Neither at this day can any man exactly and precisely obserue any one day, either as it was first appointed by *Moses* in the *Leuiticall* Law, or as it was instituted by Christs Apostles afterwards; by reason of the manifold transportation of colonies, and transmigration of Nations from one Region into another, whereby the times must necessarily be supposed to vary. And if any more moderate should vrge, that not the exact seuenth day from the first institution, bound vs to obseruation; so one day in seuen be obserued: it can hardly passe without exception, forasmuch as if any man, as *Magellane*, *Drake*, or *Candish*, should trauaile the world about a day must needs be varied, as we haue shewed. Here I would willingly demand, whether such trauailers returning home into their owne countries, should celebrate the same Lords day according to the institution of their owne Church; or else as they finde according to their owne account: If they obserue the latter, they must schismatically diuide themselves from the Church, and keepe a Sabbath of their owne, which in euery mans iudgement would be thought absurd, as the mother of many inconueniences: If the former take place, then must the day be changeable in his nature, and so one day of seuen of them should not be obserued. I speake not this to cherish any neglect of the duty we owe that day, but rather to proue it not meere to be grounded on the Law of Nature, as some would perswade; but rather an *Ecclesiasticall* constitution, deriued (as it seemes most probable) from the Apostles, though not in practice in Christs time, wherein the *Iewish* Sabbath was not yet abolished: But I haue dwelt too long on this, and may perhaps incurre sharpe censure, for wading too farre into the depth of Diuinity: But my Apology shall be this, that albeit I haue gone beyond my present subiect, I haue not yet transcended the limits of my profession: I serue no faction, and therefore dare aduenture my language as free as my opinion.

5 Concerning the longitude, two things are to be knowne, 1. The Inuention. 2. The Expresssion. The Inuention proposeth vs the way and maner of the first finding out of the longitude of places.

There are few things in nature which haue more perplexed the wits of ingenious *Mathematicians*, then the exactest way of finding out the longitude of places: Not that the matter was ouer difficult in it selfe, but that they sought out a way to performe this conclusion, not depending from the obseruation of the celestiall bodies and motions; a matter as yet neuer found out, and I feare me vnpossible: Because they proposed to themselves one of these two wayes to finde it out; either by some magneeticall instrument, or else by industry of nauigation: neither of which can much profit. Not the former, because there haue neuer beene any fixed points found in the *Equator*, betwixt East and West, as betwixt North and South haue beene obserued: so that nothing can proceed out of the meere nature of the earthly Globe, whereon we may ground any difference of longitude: Neither is the second very benefici- all, for that all voyages both by Sea & land, are very irregular and vncertaine; either by reason of sundry impediments, as rockes, mountaines, woods, contrary winds, and other dangers turning aside the direct course of passengers from any direct way, or obseruation, or else by the Ignorance of Mariners, which seldome passe so farre on discouery: and if they doe, know not perfectly to delineate out their iourney, as a *Cosmographer* would expect, to any tollerable satisfaction. Neuerthelesse, by Astronomicall obseruation, we haue many wayes left vs for the performance of this conclusion, as shall be taught in these following propositions.

1 By an Eclipse of the Moone, the longitude may be found.

This

This conclusion is in this sort to be performed: First, it behooueth you to know, as you may by an *Ephemerides*, at what houre an Eclipse shall happen at some knowne place, whereof you are well informed of the longitude: Then must be obserued by an Astrolabe, or other Astronomicall instrument, at what houre this Eclipse begins at that place, whereof you would willingly know the longitude: If the Eclipse do begin in both places the selfe-same time, you may assure your selfe that these two places differ not in longitude. But if there be a difference in the time, then must there be a difference in the longitude, which to finde out, you may in this sort proceed: Take the lesser summe of houres out of the greater, and there will be remaining, either houres or minutes, or both: If there remaine houres, then multiplie the same by 15; if minutes, diuide the same by 4; (for in this account as we haue taught, 15 Degrees make an houre) and adde the difference so found vnto the longitude, if the Eclipse appeare there sooner: but if later, subtraet it from the longitude formerlie knowne. If there remaine any minutes after the diuision, you must multiply those minutes by 15; and so shall ye haue the Minutes of Degrees. To explaine this the better, we will take this familiar example frō some of our later writers. The longitude of *Paris* was set downe by *Ptolomy*, to be 23 degrees; now we may be informed by an *Ephemerides*, that a certaine Eclipse of the Moone beginnes there 3 houres after midnight; out of this I would willingly learne the longitude of *Tubing* a towne in *Suenia*: In this towne I obserue by some Astronomicall instrument, at what houre the Eclipse there beginnes, which I finde to be at three of the clocke and 24 minutes after midnight. Then by the subtraction of the lesser number of time out of the greater, I finde the remainder to be 24 minutes, which diuided by 4, which makes one degree, the quotient will be 6. degrees: and that is the difference, which if you adde to the knowne longitude of *Paris* (because the Eclipse begins there sooner then at *Paris*) it wil amount to 29 degrees: whereby we may collect that the longitude of *Tubing* is 29. degrees. To this rule for the most part are squared all *Cosmographick*

Tables of longitude, but yet in this happen diuers errors:

1. Because oftentimes in the Artificer there wants diligence in observing the right houre and moment of the Eclipse.
 2. The diuers Epacts and latitudes of the Moone are commonly neglected; wherefore some haue thought it the best way (if it were to be hoped) that diuers exact Astronomers should at diuers places obserue the same Eclipse, & so by conferring together according to the former Rule, finde out the longitudes of those places. But exact Astronomers cannot be so easilie found in euery citie, whereof we desire to know the longitudes; or if there were such, they keepe not alwaies such correspondencie in friendship; neither is an Eclipse of the Moone alwaies at command. Neuerthelesse, this way is not to be despised, because where better waies are wanting, we must content our selues with what we finde.

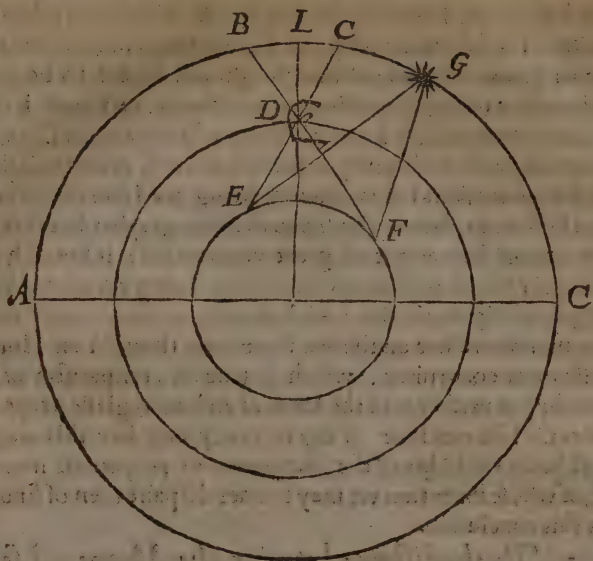
2. *By a Clocke, Watch, or Houre-glasse, to finde out the longitude of a place.*

This conclusion is to be performed in this manner; You must get you a watch or clocke, apt to runne (if you can) 24 houres; this watch must you, by the helpe of an *Astrolabe*, rectifie and set iust at such time as you depart from the place where you are, as bound to any other place, whereof you desire to inquire the longitude: during which time, your diligent care must be to preferue your watch in motion without intermission: being at last arrived at the place whereof you inquire the longitude, you were best to stay till such time as the Index shall precisely point out some perfect houre. At the same instant it must be knowne by an *Astrolabe*, what houre it is at the place where you are arrived; for if your *Astrolabe* and *Watch* should both agree in one, you might assure your selfe that there is no difference of longitude betwixt the place whence you came, and the place whereto you are arrived: For it is euident that in this sort your iourney hath beene either directly North or directly South vnder the same Meridian. But if this differ either in houres or minutes, they must be reduced vnto degrees in such sort as we haue shewed in the former way. Through which

which you may finde out the Longitude which you desire to know: This Invention is by our Countryman *Blundevill* ascribed to *Gemma Frisius*; although I should take it to be more ancient: but whose Invention soever it was, certainly it cannot but commend the Author. *Peter Martyr* in his Decades, seemes to preferre this way before all the rest; neuertheless in this I cannot assent to his opinion, being one I had rather trust as an Historian, then as a Iudicious Cosmographer: because the way cannot but admit of great vncertaintie: insomuch as a Watch or Clock will moue inæqually, being corrupted with rust, especially on the Sea, which alwaies abounds with moist vapours: wherefore on the Sea, some haue thought an Houre-glasse more convenient, which is true in comparision of the Watch; but neither will the sands of an houre-glasse keepe alwaies the like motion: If any certainty may bee this way, it must be by the helpe of the *Automaton* or perpetuall moueable, of whose inuention we may sooner despaire then of finding out this conclusion.

3 By the distance betwixt the Moone & some knowne Starre, which is situate neere the Eclipticke, the Longitude may be found out.

This way was taught by *Appian*, illustrated by *Gemma Frisius* and *Blundevill*, to whose manner of explication, wee haue for farther illustration added a Figure of the *Parallax* whereon this Invention is grounded. First then to shew this conclusion, we must first lay this ground: that the Distances betwixt the Moone & other stars in the firmament are varied according to the difference of places: Insomuch as two men liuing farre distant in diuers places of the earth, beholding at one time the Moone and some other knowne fixt starre, will not finde the like distance betwixt them: whereof if any man doubt, he may be informed by this figure. We will imagine O to be the place of the Moone, as seated in the lower Orbe; G to be the place of the fixt starre, whose distance from the Moone is inquired: E and F two stations or habitations of men dwelling on the earth, whereof we may imagine the one to be in *Europe*, the



other in *America*: It will be manifest that the inhabitant situate in E will behold the Moone in the point B; and the said fixt starre in G: (because as the *Optickes* teach vs, all things are seene in the places opposit to the eye) so that the distance betwixt the Moone and the said starre, will be the Arch of the greatest Circle B G of the other side: the inhabitants situate in E, will behold the Moone by the ray E C in C: as likewise the said fixt starre G in the point G, by the ray E G: so that the distance betwixt the Moone and the fixt starre, will be in that station the Arch of the circle C G. Now by the first common *Axiome* of *Euclide*, euery man must grant that the Arch of B G is greater then C G, the former being the whole, and this the part. Secondly, out of the same ground, wee may as easily collect that this distance betwixt the Moone and some other knowne fixt starre is varied proportionallie, according to the distances of the places on the earth, because so many places as there are, so many di-

uerfitie

uerſitie of aſpects will ariſe, being increaſed or diminifhed, according to the diſtances of places on the Terreſtriall Globe: This concluſion thus demonſtrated, we muſt proceed to practice in this manner, as is taught by *Gemma Friſius*: Firſt, it behooueth you to ſearch out by the helpe of *Aſtronomicall* Tables, the true motion of the Moone, according to the Longitude, at that time of your obſervation at ſome certaine place, for whoſe *Meridian* the rootes of thoſe Tables are calculated. 2. You muſt know the Degree of Longitude of ſome fixed ſtarre, nigh vnto the Eclipticke, either preceeding or following the moouing of the Moone. 3. You muſt ſeek out the Diſtance of moouing of the Moone, and the ſaid ſtarre. 4. The diſtance once had, apply the croſſe-ſtaffe to your ſight, and ſo mooue the Croſſe to and fro, till you may behold the Center of the Moone, at the one ende, and the fixed ſtarre with the other. So ſhall you ſee expreſſed by the Degrees and Minutes marked on the ſtaffe the diſtance of the Moone and the ſaid ſtarre correſpondent to the place of your obſervation: which being noted, ſet downe alſo the diſtance betwixt the Moone and the foreſaid Starre which was firſt calculated. Then ſubſtract the leſſer from the greater, the reſidue will ſhew the leaſt difference: which being diuided by the moouing which the Moon maketh in one houre you ſhall knowe the time in which the Moone is or was ioyned with the firſt diſtance of the foreſaid ſtarre. Then hauing conuerſed that time into degrees and minuts, the reſt will be performed either by addition or ſubſtraction of the Product thereof to or from that Meridian: for which the Tables where by you firſt calculated the motion of the Moone, were appointed and verified. If the diſtance betwixt the Moone and the firſt Starre of your obſervation be leſſer, then muſt you adde the degrees and minutes to the knowne Latitude, ſo ſhall you finde the place of your obſervation to be more Eaſtward. If it be greater, then ſubſtract the degrees and minutes from the knowne Longitude, and the place of your obſervation in this regard will be more Weſtward. Theſe rules are ſo farre true, that the Moone be ſuppoſed to bee more Weſtward then the

fixed Starre: for if other wise, your working must be cleane contrary: to wit, if the distance betwixt the Moone and the fixed Starre be lesser, you must subtra& the degrees and minutes from the knowne Longitude: so shall the place of your observation be more Westward: but if it be greater, then must you adde the degrees and minutes vnto the knowne Longitude, & the place of your obseruation shall be found Eastward. This way, though more difficult, may seeme better then all the rest: forasmuch as an Eclipse of the Moone seldome happens, and a watch, clock, or houre glasse cannot so well be preferred, or at least so well obserued in so long a voiage: whereas euery night may seeme to giue occasion to this experiment: if so bee the ayre be freed from cloudes, and the Moone shew her face about the Horizon.

4 *By the obseruation of the difference in the Sunnes and Moones motion, the Longitude of places may be found out.*

To explain this proposition, we will set downe three things. 1 Certaine *Postulata*, or granted Axioms. 2 The example. 3 The manner & practise: The grounds or propositions which we take as granted of all Mathematicians are these. 1 That the motion of the Moone is 48 minutes of an houre slower in 24 houres, or 360 degrees, then that of the Sunne. 2 That by obseruation of the heauens, and other Mathematicall helpes, an Artificer may know in any place first the Meridian: Secondly the houre of the day: Thirdly the time of the Moones comming to the Meridian. 3 The time of the Moones comming to the Meridian may be knowne by an *Ephemerides*: These things granted, wee will suppose for example, that in *London* the Moone on some set day comes to the Meridian at foure of the Clocke after Noone: 2 That in some part of the *West Indies*, the Moone be obserued to come to the Meridian the same day at 10 minutes after foure. These grounds thus set downe, the distance of Longitude of that place Westward from *London* may be found out. The manner of practise is thus to bee wrought

wrought by the golden Rule. If the difference of the Sunne & Moones motion be 48 minutes of an houre in 360 degrees, what will it be in 10 minutes? The fourth proportionall number will be 75 degrees, the distance of Longitude of the place assigned from *London*, in West Longitude; from which number the Longitude from *London* being subtracted, and the remainder from 360, the residue will shew the Longitude. If the Moone in the place assigned come sooner to the Meridian, we must count so much in East Latitude. This way I first found in M^r *Purchas* his relation of *Halls* discouery of *Groenland*, written by *William Bassin* since this Chapter came vnder the Presse: the expression of which, being as I suppose shorter and easier then in the Author, I doe owe for the most part to my worthy Chamberfellow, M^r *Nathanael Norrington*, to whose learned conference, I confesse my selfe to owe some fruits of my labours in this kinde, and all the offices of friendship. This manner of inuention, for mine owne part, I preferre before all the rest, both for certainty and facility: and (as it should seeme by *Bassin*s practise) it is more in vse amongst Marriners then the former, howsoever lesse mentioned amongst writers.

14 Thus much for the *Invention* of the Longitude: the *Expression* is the imitation of the Longitude on the face of an Artificiall Globe or Mapp; which is directed by these Rules.

- 1 The place whereof we desire to knowe the Longitude being brought to the *Brasen Meridian*, the degrees of the *Aquatour* will shew the Longitude.

This Rule may easily be explained by these three precepts. First that you must turne round the Globe on his Axell-tree, till you bring the place wherof seek the Longitude vnder the *brasen Meridian*. 2 You must diligently and exactly marke what degrees

degree the Meridian cuts in the *Æquatour*. 3 You must number how many degrees that point is distant from the first Meridian, and the number will giue you the true Longitude sought after. This also may be performed without turning of the Globe, if so be any other Meridian in the Globe signed out shall passe by the said place. For this Meridian will cut the *Æquatour* in some degree or other, which being numbred, as before from the first Meridian, will shew the direct Longitude: the like of which we haue in the second case.

2 *The Meridian running through any place of the Geographical Table, will point and designe out in the Æquatour the degrees of Longitude.*

This may easily be taught by the former way performed on the Globe: as for example, if I should inquire the Longitude of *Paris* the *Metropolis* of *France*, in a Geographical Mapp, I finde a Meridian markt out which runs, if not directly through yet very neere the said City. This Meridian I trace along to the Southerne part, till I finde it to meet and cut the *Æquatour*. Then obserue I in what degree of the *Æquatour* it makes his intersection, and I finde it to be 23 degrees 20 minutes, which is the Longitude of the place.

15 *Hauing spoken of the Longitude, the Latitude comes in the next place to be handled: the Latitude is the Distance of any place from the Æquatour, either North or South.*

What we haue spoken of the Longitude must also agree to the Latitude, that it is taken sometimes absolutely, and generally sometimes specially: in the former sense it signifies any distance or space betweene North and South, or contrariwise from South to North. Amongst the Ancients was the breadth or Latitude held to be about 80 degrees, so that the utmost bound

bound or limit to it Northward was called *Thule*, which commonly is supposed to bee *Ilands*. But the latter Navigators through their diligence haue detected so much land that it is found to stretch beyond 81 degrees toward the North, and 45 toward the South, and much farther if we will belceue the relation of *Ferdinand de Quir*, a Spaniard, who boasts a more ample discovery of the *South Indies*, then euer before hath bene knowne. But howsoever, the Latitude here defined is taken in a more speciall and stricter sense for the distance of any place from the æquinoctiall line, be it either toward the North or the South. The bound therefore from which we begin our account of Latitude is the *Equatour*; but the subject wherein it is measured is the *Meridian*: so that it is cleane opposite to the *Longitude*, for that was limited by the *Meridian*, and measured in the *Equatour*. The Latitude of a place is alwaies equall to the *Elevation* of the Pole, as we shall shew hereafter, and is diuided into the *Northerne* and the *Southerne* Latitude whereof the one is from the *Equatour* Northward, the other Southward.

16 Concerning the Latitude are to be considered the *Invention*, and the *Expression*: the *Invention* is againe twofold, *Astronomicall* or *Magneticall*.

17 The *Astronomicall* *Invention* of the Latitude is by the obseruation of the *Starrs*, vvhich is directed by these *Propositions*.

1 The *Meridian* *Height* of the *Sunne* at the time of the *Equinoctiall* subtracted from 90 degrees, will shew the true Latitude of the place.

The height of the *Sunne* at *Noone* may be found by the *Astrolobe*, *Crosse-staffe*, *Quadrant*, and many other *Astronomicall* Instruments

instruments, but in taking the Meridian Altitude, it is very fit and requisite that it be obserued diuerse times one after another with some little space betwixt, to trie whether it increaseth or decreaseth; for if it doth increase, then assure your selfe it is not full Noone; if it decrease it is past Noone: hauing thus found out the Meridian Altitude, you must subduēt it from 90 degrees, and the residue will bee the true Latitude of the place, if so be it be obserued at the time of the Equinoctiall, when the Sunne enters the first point of *Aries*, or *Libra*: as for example here at *Oxford* I obserue the Meridian height of the Sunne about the 11th of March, and I finde it to be about 37 degrees, or thereabout, which I subtract out of 90, the whole Quadrant, and the residue will be 53, which is the Latitude of the place. But if you would knowe the Latitude at any other day, or time of the yeare, then must you proceed in this manner: hauing taken the height of the Sunne at Noone (as before) you must by the Table of Declination learne the true degree of the Sunnes declination. 2 If such declination be Northernly, then must you subtract it from the foresaid Altitude or height. But if Southerly, you must adde it to the Altitude: and by such addition and subtraction, shall you haue the height of the Equinoctiall about the Horizon. 3 This height of the Equinoctiall about your Horizon, being as before subtracted from 90, will be the true Latitude of the place assigned: as for example, the 15 of August I obserue the Declination of the Sunne to be about 10 Degrees, the Sunne being in 2 Degrees of *Virgo*: I finde the Meridian height of the Sunne to be 48 degrees or thereabouts. Now because the Sunne being in *Virgo*, hath a Northern Declination, I subtract 10, which is the number of the declination, out of 48 the height of the Sun, and there will remaine 38, which againe taken out of 90, the residue will be about 52, the common receaued Latitude of the place.

2. The Meridian height of any Starre, the Declination subtracted, if it be Northernne, or added

added if it be Southerne, being subtracted out of 90, will shew at any time of the yeare the Degrees of Latitude.

The former rule serues only for the day; because it is performed by the obseruation of the Sunne, but this latter may be more necessary for Marriners, who now and then are inforced to inquire the Latitude of a place in the night when the Sunne shines not: wherefore they must flie vnto some knowne Starre by obseruation of which they may easilie performe the same; according to the rule: which differes nothing at all from that which we speake of the Sunne out of the Equinoctiall, and therefore need no other exposition then a bare example: let the fixt Starre you best knowe, be *Arcturum*, whose Meridian Altitude you finde by your Mathematicall Instrument to be 59 Degrees, and 30 minutes: then shall you learne by some Table that his Declination Northward is 21 degrees, 30 minutes: now because his declination is Northward, you must subtract it out of his Meridian Altitude, and you shall finde the remainder to be 52 Degrees, which is the Latitude for the place: as it is commonly taken, although I confesse it might be more exact: being obserued here at *Oxford*, be found rather 51 Degrees and 30 minutes.

18 The Magneticall Invention is performed by the Magneticall Inclinary Needle.

The ground of this Magneticall Invention is from the proportion betwixt the magneticall Inclinary Needle, and the Latitude of the Earth: for as we haue proued in the 13 Proposition of the 3 Chapter; the Magneticall Inclinary Needle will at euery point of Latitude conforme it selfe to certaine Angles with the Axell of the Earth proportionally to the Degrees of that Latitude: vpon which grounds Dr *Ridley* hath invented a curious instrument to finde out the Latitude for any place assigned, and for this vse hath calculated Tables, which wee hope will bee enlarged by our famous Professor Mr *Briggs*: for my part, hauing neuer seene this Instrument,

or knowing the use, I cannot enter on the description of it vntill such time as I shall haue occasion to acquaint my selfe with it.

19 The Expression is the imitation of it on the artificiall Spheare: which is againe either *Astronomicall* or *Magneticall*. The former is performed by the ordinary Globe according to this rule.

1 The point of any place or Citty first found in the Globe being brought to the brasen Meridian, will shew in the Degrees of the same Meridian the true Latitude of the same place.

This may easily be shewed in this manner by an example; If I would willingly find out the Latitude of *Oxford* in the Globe I first finde out the place in the Globe, which hauing found, I turne the Globe till I haue brought the place iust vnder the brasen Meridian: then I note what degree it designes, and that shewes me the true Latitude of the place, which I finde to be 52, or thereabouts: but if you would finde it in a Mappe or Chart, in which there is no such brasen Meridian, you must take the Parallell of the place, or at least the next vnto it, pointed in the same Mappe: Then note what degree the said Parallell cuts in the first Meridian; for that will shew the true Latitude of it by the right Parallell of the place, if not the next; so that by addition, or subtraction, you may easily guesse at it.

20 The *Magneticall* Expression depends from the Application of the *Inclinatory Needle* to the *Terrella*.

The *Magneticall inclinatory Needle* is said to conforme it selfe in the same manner to the *Terrella* or *Loadstone*, being artificially therevnto applied, as it doth to the great Globe of the Earth: so that no doubt is, but an imitation of the Latitude may

may be expressed on the little earth, or loadstone: for which use, diuers curious instruments haue beene deuised by magneticall Philosphers, to whom I referre my Readers: because I (as I said) haue little acquainted my selfe with the use of such instruments.

C H A P. XII.

Of the distances of places compared one with another.

OF the simple and absolute destination of distances, we haue treated in the former Chapter: we must in the last place handle it *comparatiuely*; that is to say, one place compared with another: whereof we are to consider the *Inuention* and *Expression*.

1 The distance is the measured space betwixt two places: which is, either *vniforme*, or *various*; vniforme is in places different, either in *Longitude* onely, or in *Latitude* onely.

3 Those places differ in *Longitude* onely, which are situate vnder the same or like *Parallels*, but diuers *Meridians*; or at least vnder op-

posite pointes of the same *Meridian*.

Of places differing only in *Longitude*, there may be three cases: For 1. they may be vnder the same *Parallell*, as the Iland of *Saint Thomas*, and *Summatra*, which lie directly vnder the *Equatour*; or *Noremberg* and *Hamberg*, which hauing very neare the same *Latitude*, differ in *Longitude*, and lie in the same *Parallell* without the *Equatour*. 2. They may be vnder the like *Paralels*, that is, in points equidistant from the *Equatour*. As *Siene* in *Egypt*, vnder the *Tropicke of Cancer*; and *Boach* in the South continent, vnder the *Tropicke of Capricorn*. 3. They may be vnder the same *Parallell* and *Meridian*, but in opposite points of the said *Parallell*: such as are the *Periaci*, spoken of in the 10. Chapter.

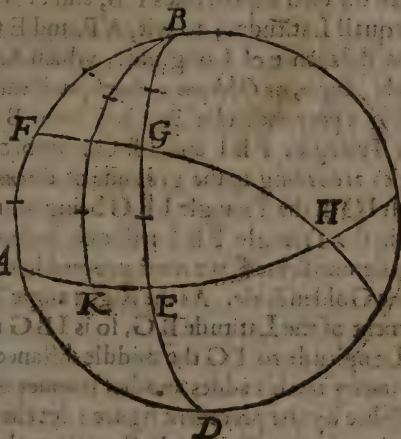
4 Places differing only in *Longitude*, whose distance is here proposed to be sought out, are seated in the same, or diuers *Hemispheres*.

5 In the same *Hemisphære*, when both places haue either *Easterne* or *Westerne longitude*. This againe may haue two cases; for either the places are vnder the *Equatour*, or without it: in both which, the finding out of the distance shall bee opened in these *Rules*.

1 If two places vnder the *Equatour* in the same *Hemisphære*, differ in *Longitude*: let the lesser *Longitude* bee subtracted from the greater, and the difference conuerted into *Miles*, and the distance will be knowne.

As for example, we will suppose of two places, whose distance is to be sought out, the former to be the Iland of Saint Thomas in Africa, the other the Iland *Summatra* in the East Indies, both situate directly vnder the *Aequatour*; and therefore differing only in Longitude. To expresse which, in this figure, let the first

Meridian from which the Longitude is to be measured, be A B C D: the place where Saint Thomas Iland is seated, K: and the place of *Summatra*, E. The



subtracting A K, the Longitude of Saint Thomas Iland being lesser, out of the Longitude of *Summatra* A E, the residue K E will shew the distance in degrees: which being multiplied by 60, and so converted into *Italian miles*, will shew how many miles the said places are distant the one from the other. As in this present example, we finde the Longitude of Saint Thomas Iland to be 32 degrees 20 minutes; of *Summatra*, to be 131 degrees: The lesser summe subducted from the greater; to wit, 32 degrees 20 minutes, out of 131; there will remaine 98 degrees 40 minutes: which being againe multiplied by 60, will produce 5920 *Italian miles*, the true distance betwixt the said places.

2. Of two places in the same Hemisphere, situate without the *Aequatour*; the distance may be knowne two wayes: either by the resolution of the *Spherical Triangle*, or else by tables

bles of the miles answerable to the degrees of Latitude.

The former way is performed in this manner: Let the Triangle of two equall sides $F B G$ in the figure before, be resolved; in which the two equall sides $F B$, and $G B$ are the complements of equall Latitudes, to wit, $A F$, and $E G$. The Angle $F B G$ is the difference of Longitude, which Angle, whether it be a *Right Angle*, or *Oblique Angle*, will easily be knowne, if by letting a perpendicular line $B I$ from B to I it be parted into two Triangles $F B I$ and $I B G$: for because those two Triangles according to the grounds of *Geometry* are equall; the Arch $I G$ in the Triangle $I B G$ being found out, the Arch also $I F$ in the Triangle $F B I$ will also be knowne; which being thus demonstrated, we must proceed in this manner, according to the Golden Rule. As the *Right angle* $B I G$ is to the complement of the Latitude $B G$, so is $I B G$ the middle difference of Longitude to $I G$ the middle distance: *Pitiscus* in his *Trigonometry* to this addes another manner of demonstration, expressible by the precedent figure: let the perpendicular $I B$ be continued vnto K , that $B K$ may make a whole Quadrant. Now will the Triangle $I H K$ haue *Right Angles* at I and K , at I by supposition, at K by his 57 proposition demonstrated in his first booke: because, *If a greater circle of the Spheare passe by the Poles of a greater circle, it will cut it at right Angles, and contrariwise*: wherefore the sides $I H$ and $K H$ must be Quadrants: because, as he shewes in his 68 proposition of his first booke, *In a Sphericall Triangle having more then one Right Angle, the sides subtending those Right Angles are Quadrants*: Finally, because the Arches $G H$ and $I H$ are the complements of the Arches $I G$ & $K E$: by the 9 definition of the first booke: Forasmuch as of any Arch lesse then a Quadrant, the complement is that which wants to make it up 90 parts. We may by the help of the 57 proportion of his first booke, seeke out the complement of the third side $G H$; which will be the Arch $G I$: which will shew vs the probleme which we sought, by reducing

ducing it vnto the Table of sines, and Tangentes, exactly set out by our forenamed Author and others. For an example of this, we may take two famous cities of *Germany*, *Noremberg* and *Hamburg*, which without any sensible difference haue the same *Latitude*, but differ in *Longitude*: For the *Longitude* of *Noremberg* is 31 degrees 45 minutes: of *Hamburg* 32 degrees 30 minutes: the difference of *Longitude* then is 0 degrees 45 minutes. These things supposed to be knowne, we will imagine *Noremberg* to be in F, *Hamburg* in G: and therefore A F, or E G will haue 49 degrees 22 minutes: F B or G B will haue 40 degrees 37 minutes: F B G or A E will haue 0 degrees 45 minutes: K E 0 degrees 22½ minutes: E H 89 degrees 37½ minutes: if we worke by the Table of *Sines Tangentes*, and *Secantes*, the knowledge whereof is required to this Probleme. But because the former way may seeme difficult to such as are not much acquainted with *Trigonometry*, some haue set downe an easier way, depending on the vse of a Table, wherein is calculated the number of miles answering to euery degree of euery Parallell of the Spheare: in which working, we ought to be directed by this Rule: *If two places without the Equatour differ in longitude only, subtract the lessr number out of the greater, and multiply it by the number of miles answerable to a degree of that Parallell, and the product will giue the distance.* As for example, if you would know the distance betwixt *London* and *Antwerpe*, which haue in a manner the same *Latitude*, but differ in *Longitude*: I finde them to differ in *Longitude* by 6 degrees, which number being multiplied by 37 miles answerable to 51 degrees of *Latitude*, these will arise to 247 miles, and 54 seconds of a mile.

*A Table of Miles answerable to one Degree of every
seuerall Latitude.*

1			2			3		
D	M	S	D	M	S	D	M	S
1	59	59	16	57	41	31	51	26
2	59	58	17	57	23	32	50	53
3	59	55	18	57	4	33	50	19
4	59	51	19	56	4	34	49	15
5	59	47	20	56	23	35	49	9
6	59	40	21	56	1	36	48	32
7	59	33	22	55	38	37	47	55
8	59	25	23	55	14	38	47	17
9	59	16	24	54	49	39	46	38
10	59	5	25	54	23	40	45	58
11	58	54	26	53	6	41	45	17
12	58	41	27	53	28	42	44	35
13	58	2	28	52	59	43	43	53
14	58	13	29	52	29	44	43	10
15	57	57	30	51	58	45	42	26

4			5			6		
D	M	S	D	M	S	D	M	S
46	41	41	61	29	5	76	14	31
47	40	55	62	28	10	77	13	30
48	40	9	63	27	14	78	12	28
49	39	22	64	26	18	79	11	27
50	38	34	65	25	21	80	10	25
51	37	46	66	24	24	81	9	23
52	36	56	67	23	27	82	8	21
53	36	7	68	22	29	83	7	19
54	35	6	69	21	30	84	6	16
55	34	25	70	20	31	85	5	14
56	33	33	71	19	32	86	4	11
57	32	41	72	18	32	87	3	8
58	31	48	73	17	33	88	2	5
59	30	54	74	16	32	89	1	3
50	30	0	75	15	32	90	0	0

6 The distance of places differing onely in Longitude in diverse Hemispheres is found out by this rule.

1 *Let the greater Longitude be subtracted from the whole circle, and vnto the residue added the lesser Longitude, there will arise the Distance betwixt those places.*

As for example, *Lisbone* in *Spaine* hath in East Longitude 13 degrees: and *Cape de Los Slavos* in *America*, hath in West Longitude 334 degrees: to knowe the distance betwixt those places, you must first subduct 334, which is the greater Longitude out of 360 the whole circle, and there will remaine 26 Degrees, to which if wee adde the East Longitude of *Lisbone*, which is 13 degrees, it will make 39 degrees, which is the true difference of those Longitudes: which being multiplied by the Number of miles in the Table going before, answerable to the Latitude of the said places (if they differ only in Longitude) there will arise the number of miles contained in the Distance.

7 Distant places vvhich differ only in Latitude, are such as lye vnder the same Meridian, but diverse Parallels: These are supposed to be either in One, or in Diverse Latitudes or Hemispheres.

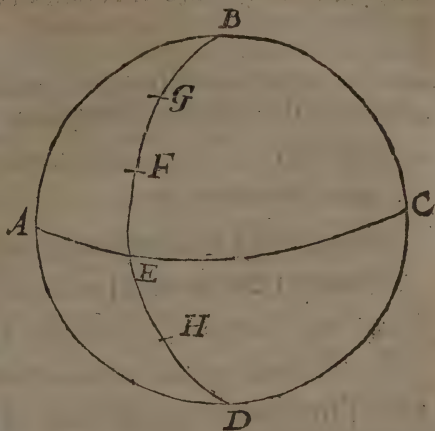
8 In One, when both the places haue either North Latitude, or both South Latitude: The finding out of which distances depends on these Propositions.

1 *If the Latitude of each place be towards the same Pole, subtract the lesser from the greater Latitude, and the residue convert into miles.*

The

The reason may be explained in this Figure: we will imagine

E F to be the lesser, EG the greater Latitude. There will remain an Arch of the Meridian FG: which being multiplied by 60 (being part of a great circle, will make the number of miles answerable to that distance. For an example we will take two Cities of England, Oxford and York.



The Latitude of Oxford, we take to be 51 degrees 30 minutes: of York 54 degrees 30 minutes. The lesser Latitude subtracted from the greater, there will remain three degrees, which being multiplied by 60, will render 180 Italian miles, the Distance of those two places.

- 2 If two places in Latitude only distant, be situate in diverse kindes of Latitude: adde the Latitude of the one to the other, and the whole summe shall be the distance.

As for example, in the former Diagram, imagining as in the former case BD to be the Meridian of those distant places, and AC the Equator: we will suppose the one place to be situate towards the North Pole, as in G; the other towards the South, as in H: then as appears by sense, will the distance be the Arch of the Meridian GH, whereof GE, and EH, are parts, whereof it is compounded: wherefore it must needs follow that those parts added together make the whole distance: for example we will take Belgrade in Europe, and the Cape of good hope in Africa, which have neere the same Longitude, to

wit, 48 degrees 30 minutes: but they differ in Latitude in such sort, as the former hath of the Northerne Latitude 44 degrees 30 Minutes; the other of Southerne Latitude about 35 degrees 30 minutes. These two numbers added together, will make 80 degrees, which being multiplied by 60 will produce 4800 miles the distance of those places.

9 Hitherto of the distances of places which are *Vniforme*, that is to say, of such as differ either only in *Longitude*, or only in *Latitude*: we are next to consider of such distances as are *various*, wherein the places differ both in *Longitude* and *Latitude*.

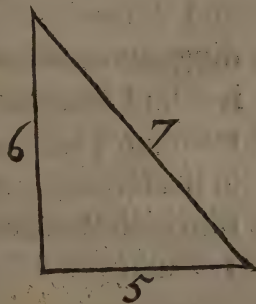
10 The Invention of such a distance, may be performed two waies, either *Abstractively* by the resolution of *Triangles*, or else *Mechanically* by Instruments. The former againe may be two waies, either by the *Right-line Triangle*, or by the *Sphericall*: The inuention of the distance by the *Right-line Triangle* depends on these following Propositions declaring two waies of Invention.

11 The first is by a *Rectangle Triangle* barely considered by it selfe: according to this Theoreme.

I The square Root of the number made of the differences of *Longitude* and *Latitude* of two places

places distant, will shew the distance of those places.

The ground of this Proposition is taken from the 27 Proposition of the first booke of *Euclide*: where it is demonstrated that the square of the Hypotenuse, or greatest side of a Rect-angle Triangle is æquall to the two squares made of the two other sides: which being well understood, will lend an easie light to this proposition. To performe which we must first take the difference of Longitude, which is imagined to make one side of this Triangle. Then must we obserue also the Difference of Latitude, which is supposed to make another side. Then are we sure by the former Proposition of *Euclide* that the squares of these two sides, are æquall to the square of the *Hypotenuse*, or third side; which is to be sought out, and expresses the distance betwixt those places: wherefore we must first multiply these two sides in themselves, whence they will become squares. 2 We must adde them together. 3 We must out of the totall extract the Quadrat root, which will shew the distance: as suppose according to this Figure, two Cities distant and differing both in Longitude and Latitude: whereof the one shall haue in Longitude 21 degrees, in Latitude 58: the other is supposed to haue in Longitude 26 degrees, in Latitude 52. Here first I subtract the lesse Longitude out of the greater, to wit, 21 out of 26, and the residue will be 5, which I suppose to be one side of the Rectangle Triangle. Then likewise I subtract the lesse Latitude as 52 out of 58, the residue will bee 6, which I make the other side of my Triangle, which done, I multiply 6 in it selfe, and it makes 36, which is the square of one side: Then I multiply 5 in it selfe, and the Product will be 25, the square on the other side. These two squares added together by the foresaid Proposition must be æquall to the square of the *Hypotenuse*,



or third side 61, whereof the square root being extracted, will shew the side it selfe, which will be $7\frac{1}{2}$, which is the distance: If any man desire to knowe this distance according to Miles, he must reduce the degrees of Longitude and Latitude into miles according to our former rules, before he begin to work: because (as we haue shewed) the degrees of Longitude being measured in the Parallels are not alwaies æquall, the Parallels being some where greater, some where lesser. This way must needs be more exact, in that a Mile is a smaller part then a Degree, and (as *Pitiscus* notes) the Fractions which fall out in extraction of roots can hardly be reduced to any proportion. Neverthelesse this way of finding out the distance by a Right-line Triangle, howsoeuer common and receaued, is very vnperfect and subiect to great error, especially in places far distant: forasmuch as it supposeth the Meridians with the Parallels on the Globe to make true squares, whereas indeed all the Meridians meet in the Pole, and so by consequence cannot make true squares: But yet this error is far lesse in a lesser distance; because in a small space of earth, the roundnesse and conuexity of the Earth is insensible, or at least of very small importance: so that this way cannot be altogether vnusefull.

12 Another is found out more exact then the former by the Tables of *Sines*, *Tangents*, and *Secants*. This is performed by finding out the numbers: whereof the former is called *Inuentum primum*, or the first found number. The second *Inuentum Secundum*, or the second found number. The working of which Probleme depends on these rules.

1 Multiply the Right Sine of the difference of the longitude into the summe of the complement of the lesser latitude, and divide the product

duct of that multiplication by the totall summe, and then by the rules of Sines and Tangents the Arch of that Quotient found out will give the first found number.

2 Multiply the right sine of the lesser Latitude by the totall sine, and having divided the product thereof by the sine of the complement of the first number, subtract the Arch of that quotient out of the greater Latitude which gives the second found number.

3 Then multiply the sine of the complement of the first found number into the sine of the complement of the second found number, and having divided the product by the Totall Sine, Let the Arch of the quotient be sought out by the Tables, which Arch subtracted out of the whole quadrant, will give the degrees of a distance in a great circle.

To expresse the practice and manner of working according to our former Rules, we will suppose the two cities whose distance is heere sought out to be Jerusalem and Norimberge in Germany. Jerusalem hath in longitude 66. degrees. 0. min. and in latitude 31. degrees. 40. minutes. Again Norimberge hath in longitude 28. degrees. 20. minutes, and in latitude 49. deg. 40. min. The difference of their longitude is 37. deg. 40. minutes. The right sine whereof is 36664. (for here we make 60000 to be the totall sine, rejecting the two last figures on the right hand in the tables of *Regiomontani*.) Now you

must multiply 36664 into the sine of the Complement of the lesser latitude, which is 51067: the product of which two sines being multiplyed the one by the other, there will arise 1871320488: which if you diuide by the totall sine 60000, the quotient will giue you 31205, whose Arch is 31 deg. 20 min. and this must be your first found Number.

For the finding of the second Number, you must proceede in this manner: Multiply the right sine of the lesser latitude, which is 31498 by the totall sine 60000, & the product will be 1889880000: which summe, if we diuide by the sine of the Complement of the first-found Number, which is 51249, we shall finde, the quotient 35876; the Arch whereof is 37 degrees, 55 min: which Arch subtracted out of the greater latitude, there will remaine 11 degrees, 29 min: and this is our second-found Number. These things thus supposed to be found out, we must multiply the fore-said sine of the Complement of the first-found Number, which is 58798, and the product will arise to 3013338702, the Arch whereof is 56 deg. 50 min: which being subtracted out of the whole quadrant, viz: 90 degrees, there will remaine 33 degrees, 10 min: of the greater circle. These 33 deg. if we multiply by 60, there will arise 1980 miles, whereunto if we finde the 10 miles answerable to the 10 min. we shall finde the distance betwixt these places to be 1990 Italian miles. This example is vsed by *Appian*, and wrought according to his own Tables, and farther explained by our countryman *Blundevill* in his Exercises. The same way of working hath bin deliuered by *Clavius*, *Tanctinus*, and others, although not according to the same Tables. This way of measuring the distance by the *Sines* and *Tangents* according to these authors, may be warrantred more exact than the other, because it admits of smaller parts in the calculation; yet will it come far short of truth.

10. Another way of finding out the Distances of places, differing both in longitude and latitude, is by the Resolution of a
Spha-

Sphæricall Triangle.

This way of all the rest must needs be most certaine: forasmuch as this kind of Triangle best expresth the sections of the Globe. The methode of which working I finde nowhere better taught then in *Pitiscus* his *Trigonometry*: of whose ingenious industry notwithstanding little use can bee made, except the Learner first acquaint himselfe with his principles, because in his *Geographicall Problemes*, he briefly referres his Reader to his former grounds and *Axiomes*, accurately demonstrated in his former bookes: For mine owne part it might perhaps seeme as absurd in this Treatise, to intermixe all his preparatory demonstrations, being meerely *Geometricall*, and without the limites of my subject, as by leaving out so necessary a way to mangle my discourse. Wherefore intending a middle way, I will (Godwilling) in such sort set downe these propositions, that I may giue some light to this excellent Invention, and referre my Reader to *Pitiscus* his *Axiomes* for farther Demonstration.

14 The Distances proposed to be measured by Sphæricall Triangles, admit of two cases: 1 When two places are so situate, that the one is vnder the *Æquatour*, the other without. 2 Secondly, when both are without the *Æquatour*.

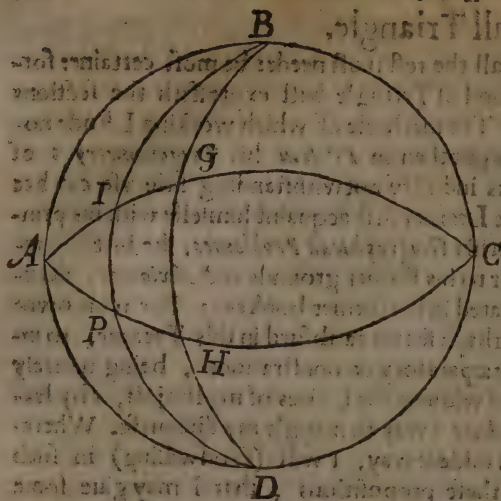
15 The former againe is three fold: For either the difference of longitude betwixt those places is *Æquall* to a quadrant, or *Lesse*, or *Greater*. The severall wayes of Invention shall be directed by these Rules.

1 If the Difference of longitude be *Æquall* to a quadrant, the Distance will also be a quadrant.

317

H h 2

As



As for example in this present figure we will imagine the circle ABCD to be the first Meridian: the places whose distance is sought out A and G: whose Distance A G will be a quadrant. For A will be a Pole

of a Greater Circle BGD, by the 56 prop. of the 1 of *Pitiscus*: wherefore all the Arches drawne from thence to BGD will be quadrants by the same proposition. For a more familiar instance we will take the Iland *Sumatra*, which hath in longitude 131 degrees, but no latitude, being sited vnder the Equatour: and the city *Buda* the Metropolis of Hungary, which hath in longitude 41 degrees, in latitude 47 degrees; The difference of longitude is 90 degrees; for 41 being subtracted out of 131, there will remaine 90, wherefore the distance betwixt those places will be 90, which being multiplied by 60, will produce 5400 Italian miles.

2. If the difference of longitude be lesse then a quadrant as AF: the Triangle AEF here is to be resolved into his parts, according to the 4th Axiome of *Pitiscus*:

As for example the places whose longitude is heere sought out, shall be A and F. The Triangle here to be known is AEF; whose Resolution depends on our Authors 4th Axiome. For the

the Difference of longitude is ABF ; because the measure of a Spherical Triangle being taken in a great circle, is an Arch of a greater circle, described from the Angular point; and comprehended betwixt the two legges of the Triangle so far as a quadrant, as is taught in the 58 proposition, of his first Booke. For a more speciall Instance we will take two places, whereof the one shall bee the Iland of *S. Thomas* before mentioned, which hath in longitude 32 degrees and 20 minutes. The other *Amsterdam* in *Holland*, which hath in longitude 26 degrees, 30 minutes. The former we imagine in A ; the later in F . The Difference of longitude ABF wilbe 6 degrees, 50 minutes. Then the distance sought out must be AF ; so working according to the fourth Axiome of *Ptolemy*, we shall find the Arch AF , which is the distance, to be 54 degrees, 19 minutes.

3. If the Difference of longitude be greater then a quadrant, as of the two places F and C , the Triangle to be resolved wilbe FCE , being a Rectangle at E .

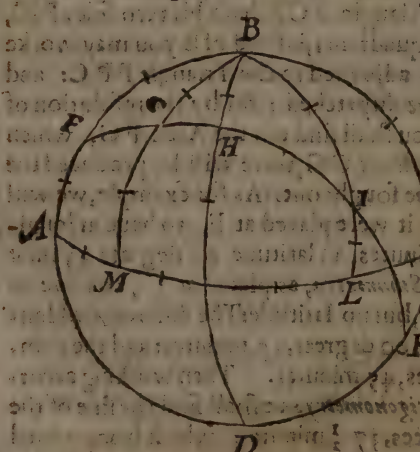
Heere because the Triangle FCE hath his two sides F , C , and EC , greater then quadrants, instead of it you may worke on the Triangle IEF , adjoynd to the Triangle $FE C$: and the whole worke wilbe dispatched: for by the resolution of the Triangle AEF , you shall find out the Arch FG , which being added to the quadrant CG , there will be produced the Arch FC , which is to be sought out. As for example, we will imagine *Heidelberg* as it were placed at F , to haue in longitude 30 degrees, 45 minutes, in latitude 49 degrees 35 minutes. Then we will suppose *Summatra*, as placed at C , to haue in longitude 131 degrees, but no latitude. The difference of longitude will be EC , of 100 degrees, 15 minutes: and the complement AE 79 degrees, 45 minutes. Then working according to the Rules of *Trigonometry*, we shall find the sine of the Arch FC , to be 6 degrees, 37 $\frac{1}{2}$ minutes; which being added to FG , being 90 degrees, will produce 96 degrees, 37 $\frac{1}{2}$ minutes, to which Arch there will answer 449 German miles.

16 The second Case is, when both places are situate without the *Æquatour*: This is againe two-fold: For either the two places are vnderstood to be situate towards the same Pole, or else one place toward the Northerne, the other towards the Southerne Pole. Both vvhich Cases shalbe taught in these Rules.

1. If both places whose distance is sought, be situate towards the same Pole, there will arise a Triangle, whose sides and Angles will bee knowne by the fourth Axiome of Pitiscus in Trigonometry the fourth Booke.

As for example, in this present figure let the two places gi-

uen bee F G, the Triangle to be knowne, will be F B G, whose acute Angle will be at B. Let the places given be as F H, the Triangle to be resolved & knowne, will be F B H, having a right Angle at H. Finally, if the places supposed to be given, are as E I, the Triangle to be knowne will be F B I, with an obtuse Angle at I.



2. If

If the one place be situated towards the North-pole, and the other towards the South-pole, there will arise a Triangle, whereof the one side about the Angle which is giuen, will be greater then a quadrant.

As in the former figure, let the places giuen be as G and K, also H and K, also I and K: There will still fall out a Triangle, whose one side containing the Angle giuen, will be greater then a quadrant, as B K: wherefore for the side B K, you must take his complement to the Semi-circle B F, that is, for the Triangle G B K, you must worke by the Triangle G B F: and instead of the Triangle H B K, you must take the Triangle H B F: and for the Triangle I B K, you must worke by the Triangle I B F, according to the fourth Axiome of the fourth booke of *Puisem*, to which I had rather referre my Reader, then intermize our *Geographical* discourse with handling the Principles of *Geometry*, which heere are to be supposed so many precedent propositions; which, expressed as they ought, would transcend the bounds of my intended journey.

I 7 Of the *Abstractive* vway of finding out the Distance of places, vve haue spoken: The *Mechanicall* depends on the vse of Instruments & Mechanicall operation, vwhereof vve vwill shew one vway in this Theorem.

I By the working with a Semi-circle, the Distance of two places may be found out.

This Invention by *M. Blundevill*, seemes to be ascribed to *Edward Wright*, yet hath it bin taken vp of forreigne Writers as their owne, and vsed in their Charts and Mappes. The manner of operation is thus: First, let there be drawne a semi-circle

circle vpon a right *Diameter* signed out, will be the letters A B C D, whereof D shall be the center, as you find it deciphered in this present figure. The greater this *Semi-circle* bee made, so much the more easie will be the operation; because the degrees will be larger. Then this *Semi-circle* being drawn, and accordingly diuided, imagine that by the helpe of it, you desire to find out the distance betwixt *London* and *Ierusalem*, which cities are knowne to differ both in *longitude* and *latitude*. Now, that the true distance betwixt these two places may be found out, you must first subtra^t the *lesser longitude* out of the greater, so shall you finde the Difference of their longitudes, which is 47 degrees. Then reckon that Difference vpon the *Semi-circle*, beginning at A, and so proceed to B; and at the end of that Difference, make a marke with the letter E, into which point by your Ruler, let a right line be drawne from D the center of the *Semi-circle*. This being in this sort performed, let the *lesser latitude* be sought out, which is 32 degrees in the foresaid *Semi-circle*, beginning your account from the point E, and so proceeding towards B, and at the end of the *lesser latitude*, let another point be marked out with the letter G: from which point let there be drawne a perpendicular, which may fall with right Angles vpon the former line, drawne from D to E; and where it chaneeth to fall, there marke out a point with the letter H. This being performed, let the greater *latitude*, which is 51 degrees, 32 minutes, be sought out in the *Semi-circle*, beginning to reckon from A towards B, and at the end of that latitude, let downe another point, signed out by the letter I: from whence let there be drawne another perpendicular line, that may fall with right Angles vpon the *Diameter* A C, and here marke out a point with the letter K. This done, take with your Compasse the distance betwixt K and H, which distance you must set down vpon the *Diameter* A C, placing the one foote of your Compasse vpon K, and the other towards the center D; and there marke out a point with the letter L. Then with your compasse take the shorter perpendicular line G H, and apply that wideneffe vpon the longer perpendicular line I K, placing the

Edward Foster his Book

Born February the 22nd
anno Domini 1739

Whose Book I am if you
would know in letters too
I will show the one is J. f.
great of might the
at the J. in all main sight an
if you chane to spell
omese look up above and
there it is



GEOGRAPHY THE SECOND BOOKE.

CONTAINING THE GENERALL
Topicall part thereof.

By NATHANAEL CARPENTER
Fellow of Exceter Colledge
in Oxford.

GENES. I. ver. 10.

*And God called the Dry-land, Earth; and the gathering
together of the waters called he Seas: and
God saw that it was good.*



OXFORD,

Printed by JOHN LICHFIELD and WILLIAM
TURNER, Printers to the famous Vniversity,
for HENRY CRIPPS. An.Dom. 1625.

Edward Foster His Book
Barn October the 22 1760

~~Edward Foster~~ and not
seed is which is
of seed and now
the ~~seed~~ weeds begins to
grow
1760. 1761

~~Edward Foster~~
his



TO THE RIGHT
HONOURABLE

PHILIP,

EARLE OF MOUNTGOMERY

etc. Knight of the most Noble

Order of the Garter, & Steward

of the famous Univer-

sity of Oxford.

Right Honourable,



His Geographicall Treatise

consisting of two parts, was

in the very birth in such sort

consecrated to your inesti-

mable Brother, as notwith-

standing it so farre reserved

it selfe, to awaite your Honours favour, that

Both may receive, as to share a part, to be

chal-

THE EPISTLE

challenge the *whole* in my poore *Industrie*.
The *Soule* of *man* which some Philosophers
imagine, to be *all in all*, and *all in euery part*,
seemes to me no where better resembled
then in your Generous *Fraternity*; wherein
the *Soule* of *Heroicall Magnificence*, though
Indiuided in it selfe, so *entirely* communicates
herselfe to either, that both may seeme at
once to *enioy* her presence, while neither *want*.
If this my bold attempt in presenting to your
Honours hands these vnworthy labours, with-
out any former reference, might be interpre-
ted intrusion, it were enough for *Jngenuity* to
pretend, that your generous loue vnto our
poore *Colledge* and the respectiue duty where-
in the *Colledge* alwayes stands obliged vnto
your *Honour*, commands my penne beyond
manners or *ability*. Your affection to our *house*,
could no way expresse it selfe ampler, then by
trusting our custody, with the charge of
R.L^d. D. your choicest lewell: A *Gentleman* of that
towardly *wit* and sweete *disposition*, that *Learn-*
ing and *Morality* commonly reputed the
daughters of *time*, seeme in him scarce behol-
ding to *yeares*, and to challenge a precedency
before

DEDICATORY.

before *experience*; insomuch that our ancient Mother markt out with all the Characters of age and declining *weakenesse*, cherishing in her bosome this yong darling, seemes to resume her *youthfull* habit, and triumph ouer *Time* and *Ruines*. This happines amongst diuerse others vouchsafed by your Honor to the place, for whole good opinion the best part of mine endeouours stand engaged, hath encouraged my *hopes* to promise me your indulgent Acceptance of this slender piece, long since intended and devoted, as my selfe, vnto your seruice: In which confidence, fearing any longer to trespasse on your serious and high imployments *endehted* to your King and Countrey, I humbly rest

Your Honours in all duty and

seruice to be commanded

NATHANAEL CARPENTER.

Vol. 1, No. 1, 1891

STRENGTH & QUALITY

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The Cock, Doves Crow
Let
So If I know
That it Time
to Rise
1773



GEOGRAPHIE:

THE SECOND BOOKE.

CHAP. I.

*Of Topographie and the nature of a
place.*

I N the former Treatise, by Gods assistance, we haue treated of the *Sphericall* part of *Geographie*: It will in the second place seeme conuenient to speake of the *Topicall* part of it.

2 The *Topicall* part teacheth the description of the *Terrestriall* Globe, so farre forth as it is diuided into places.

The nature of *Topographie*, whereof we are to treat in this second part, is discovered vnto vs, not only in the name, which promiseth a description of places; but also in the differences set down by *Ptolomey* himselfe, betwixt the *Sphericall* and *Topicall* part: the former of which he calls *Geographie*, and the lat-

ter *Topographie*; whereof we haue spoken at large in the first Chapter of our former booke. Here onely we will note this one distinction, that *Topographie* may be taken either more generally, or specially: Generally we may take it so farre soorth, as it discouers vnto vs either, the whole world and all his parts, or at least some great and principall parts; such as is an *Empire*, *Region*, *Kingdome*, or such like. More specially and particularly, it hath vsually beene taken for the description of a very small place, whose situation in respect of the heauens is not noted, but of the parts one to the other: such as are *Cities*, *Burrowes*, *Townes*, *Castles*, *Lakes*, and *Riuers*. The former (whereat we chiefly aime) cannot well be performed without the vse of the *Spharicall* part: The latter we will more sparingly touch, being an infinite taske in the whole earth to descend to all particulars which come in our way: yet shall we not altogether omit or neglect such circumstances in their due places, so farre soorth, as we can; leauing the rest to such *Topographers*, who spend their stocke in the description of some particular place or Region: whereof this our Age hath produced many deseruing high commendations. This Science was anciently adorned by *Homer*, *Anaximander*, *Milesius*, *Hacataus*, *Democritus*, *Eudoxus*, *Dicaarchus*, *Euphorus*, as we finde in *Straboes* first booke: to which afterward succede, *Eratosthenes*, *Poivybius*, *Possidonius*, and diuers others. Which part requires little or small knowledge in the Sciences *Mathematicall*, but challengeth more affinity with the *Physicall* and *Politickall* part of *Philosophie*; and therefore is more subiect to popular vnderstanding then the former, and may without it, afford some profit to the Reader.

- 3 The *Topicall* part is either generall, or speciall: The generall is that which handles the generall Adiuncts of a place.
- 4 A place is a superficial space of the Terrestrial Globe, fitted for habitation.

To the constitution of a place (as it is here *Topographically* taken) there ought to be a concurrence of two things, which we may call Matter and Forme. The Matter is the space contained; or superficiall platforme of the earth whereon we dwell. The forme is the capability or aptnesse of it for habitation; both which concurring together are conceiued to make a place, such as we here *Topographically* vnderstand: for here we vnderstand not a place *Physically*, for the receptacle of a naturall body; in which sense the Heauens and all the elements are said to haue their naturall places: Neither yet *Geometrically* for a plaine whereon a line or figure may be drawne: but *Topographically* for the vpper face of the earth whereon people or other liuing creatures may inhabite. This place as appears by reason and holy Scriptures was more ancient then habitation. For whereas in the first Masse the earth was inuelped with waters on euery side, affording no place for dwelling; Almighty God is said afterwards to haue seperated and parted the waters from the dry land, making the one a Recepracle for Fishes, & such creatures of the deep, the other for a dwelling place for mankind, and such creatures as breathe vpon the land: yet hath he so prouided in his diuine wisdom, that neither the Inhabitants of the land can well want the Sea, nor the liuing creatures in the Sea want the land. The one appears in that we are inforced to make vse of the sea, not onely for food and nourishment, whereof a great part consisteth of fish: but also for our Traffique and commerce with forraine Nations, which is better effected by Sea then Land-voiajes. The latter is as easily shewed, in that the fishes of the Sea deriue not only their composition, but also their proper nourishment from the land: wherof we shall haue more occasion to speake hereafter. Now we are moreuer to consider, that a *place* may be taken in a double sense: first more largely for any place wherein a creature may liue for longer or shorter time. Secondly, more strictly for such a space of earth, whereon mankind may conueniently reside or dwell. The former comprehends not onely the land; but also the water; for experience shewes, that men in ships may for a time reside and dwell on the backe

of the maine Ocean. But the latter betokening a continuance of habitation, is onely agreeable to the land: Which sense howbeit it be more consonant to the common vse of speech, yet for methode sake, weare inforced to vse the former: vnderstanding by habitation, not onely a place of conuenient residence, but any other whereon a creature for a time may breathe and liue.

I The Terrestriall Sphere is euery where habitable.

It was an ancient opinion (as we haue formerly touched) that the earth was not euery where habitable: namely, in the *Intemperate Zones*, whereof the one was placed in the middle of the earth, the other at the endes: the former was thought not habitable by reason of the extremity of heat; because the Sun-beames there fall perpendicularly, and so make a greater reflection; The other for extremity of cold, by reason of the obliquity of the Sun-beames, causing little or no reflection: whence a second cause seemes to be drawne from the extreame drought of those places, which seemes most opposite to mans temper, requiring a reasonable degree of moisture. But notwithstanding these reasons of the ancients, it must needes be confessed as an vndoubted, truth confirmed by experience of many Nauigatours, that those Regions by them imagined vnfit for habitation, are not onely habitable, but in many places very populous. Neither want there many reasons found out by latter writers, to mitigate the rigour of this opinion: some whereof we haue already touched in our former treatise. First, whereas they vrge the places vnder the *Æquinoctiall* to be vnhabitable by reason of intemperate heat; we may easily answer, that the dayes and nights are then alwayes equall, containing not aboue 12 houres, so that the space of either being shorter, the cold of the night may well assuage the extreame heat of the day. Another reason is ordinarily taken from the extraordinarily high mountaines, commonly placed vnder the *Æquinoctiall*, which approaching neerer the middle Region of the aire, must of necessity partake somewhat more

of

of cold; which daily experience can witness, in that their tops are covered with snow even in the depth of Summer. Thirdly, the neerenesse of the maine *Ocean* to a great part of this Region, is a great cause of this cold temper, because water is found to be by nature cold. Fourthly, the set and certaine windes by nature ordained to blow in the hottest times of the yeare, may adde much to temperature. Fifthly, the extraordinary Raines & showers which those places suffer, which are vnder the Line, especially when the Sunne is verticall, are a great cause of the asswaging of the heat of the Sunne. Lastly, the custome of the Inhabitants being from their cradles inured to no other quality or disposition of the ayre, will take away much from our admiration. On the other side no small reasons may be shewed, why, the Regions lying neere or vnder the *Pole* should not be so extreemely cold, but that they may admit of habitation. First, because the Sunne being for six moneths together above their Horizon, must needs presse into the Ayre more heat then otherwise it would doe. Besides, the thicknesse incorporated (as it were) with heat, must needs receaue into it more degrees of it then a thinner and more refined ayre, because the intention of the quality most commonly supposeth the condensation or thickning of the subiect wherein it is. But no greater reason can be shewed in this point then the custome of the Northerne inhabitants, exposed from their infancy to no other temperament. If we should aske a reason why we vnmaske our faces against the encounter of the greatest cold, being a soft and tender part, nor daring to vncover our other parts, what reason can a man inuent but custome? If any should aske why barbarous people liuing in farre colder climates then this of ours, goe altogether naked, whereas the cold is mother of many diseases amongst vs who goe alwaies clothed; only vse and custome can yeeld an answer. These reasons make it probable enough, that no place of the whole world is by nature made not habitable. Now that it is not only inhabitable by nature, but also for the most part truly inhabited, will appeare as easily, if we trust the testimony of Navigatours which haue discovered few or no Regions want-

ting some Inhabitants. But that this proposition may be more distinctly vnderstood, we must knowe that the whole world is divided into *Sea* and *Land* for the *Sea* we may call it habitable in that large sense before mentioned; to wit, that on it euery where men in ships may breath and liue; which is plaine out of experience of Nauigatours, who haue sailed round about the Earth from *East to West*, and haue entred farre towards the *North* and *South*: where at least some times of the yeare, or other they might finde the way passable: For the land which is here principally vnderstood, wee must note that it may be considered two waies; either for euery little quillet or parcell of land contained in the superficies of the Earth; or else for a certaine Region of some indifferent greatnesse. In the former sense, it were too much to affirme every part of the Earth to be habitable; forasmuch as many places, as the toppes of the *Alpes*, or the sands of *Africa*, properly admit of no habitation; yet in an improper & large sense they may be called habitable, because on them a man may liue and breath for a certaine space of time. But if by the parts of the land wee vnderstand some reasonable greatnesse, no great doubt can bee made, but that it is either already inhabited by mankinde, or can at least admit of habitation, as that which not only for a time affords a man life and breath, but also some conuenient meanes of sustenance; for no country hath euer beene found so indigent & barren of all vitall aides, which is neither capeable of liuing creatures in the land, fit for mans nourishment; or that cannot drawe *Fishes* from the *Sea*; or if this should faile, cannot afford *Fruits* or *Herbage* from the ground: or in case all the rest were deficient cannot haue passage by *Water* to other Countries, whence to relieue their necessities. And no question but nature hath stored euery Country with some commodity or other which by trafficke may drawe riches from other Regions, as by instances may more particularly appeare hereafter when we shall speake of particular Regions, and their seuerall accidents.

2. *All places of the Earth haue suffered manifold*

*fold alteration and change as well in Name
as Nature.*

I need not spend time to demonstrate this Assertion, for that euery place of the Earth hath beene subiect to much mutation in the proceſſe of time, as well in Nature of the *Soyle* as of the *Inhabitants*, a few obuius instances in each Countrey will easily certifie: yet will it not seeme amiſſe, I hope, to shew the progresse, manner, and causes of this alteration, which would giue no small satisfaction. To discourse of all changes according to all times were a matter infinite: We may referre all to two heads, to wit, the change of *Names*, and the change of *Nature*. Concerning the former that most Countries haue changed their first and originall names, is most euidēt to such as consult the Maps and writings of our common Geographers: for few or none will discouer vnto vs any Region by that name, by which it was knowne in former times: insomuch, as great controuersie & dispute hath grown about diuerſe countries mentioned by ancient writers, whereof the name should take its first originall; but of this change we shal speak hereafter. But if we consider the naturall changes of Countries since the first creation wee shall finde them to haue suffered as well in the naturall accidents, and disposition of the soile, as the temper of the *Inhabitants*; concerning the former we may note a twofold alteration; whereof the one is a progresse from *Imperfection* to *Perfection*; the other contrariwise, from *Perfection* to *Imperfection*. The first groweth out of the generall Industrie of mankind, which is wont to worke euery thing as neere as it can to his best ends and vse, for his owne good and propagation of his kinde: which we may best finde in the first originall of the world, the first ground work of ciuill societie; for man being once expelled out of *Paradise* for his owne transgression, had lett him notwithstanding for his lot the whole world b. sides, which no question he found as in the cradle of Nature a poore infant, as yet altogether vnshaped and vnshaped for humane habitation. For who can imagine the earth at that time to be any otherwise then as a vast *Wildernesse* all
outgrowne

ouergrowne with briers and bushes growing of their owne accord out of the Earth: Moreouer what *Fennes, Baggies, Marishes*, and other such incombrances could there be wanting to those places which neuer yet felt the chastising hand of husbandrie? All these incommodities, as mankind began to multiply & propagate it selfe on the face of the Earth, were by little & little removed, and the Earth reduced into a better forme for humane dwelling: because euery man choosing out his owne possession, began presently to till & manure the soyle with all heedfull industrie. For if our first Parents being placed in *Paradise* it selfe, the most pleasant & fertile portion of the whole world, were neuerthelesse enioyned to dresse and manure the Garden for their better vse and profit; what shall we imagine of the other parts of the Earth, which (no doubt) a thousand degrees come short of this perfection: especially knowing this curse to bee laid on; man by our Creatour: *That he should eat his bread in the sweat of his browes*; as though the earth were bound to open her treasures onely to mans paines and labour. And howsoeuer the diligence of mankind hath gone very far in adorning and fashioning the vpper face of the earth, yet hath it not waded so farre, but that many places in our times are left altogether rude and vncultured, groaning vnder vast Wilder-nesses and vnprofitable desarts. For times past we might haue for instance, gone no farther then *Britanie* and *Germanie*; both which Countries we shall finde in these daies to differ as much from the daies of *Cesar*, as *Cesar* iudged them to differ from the *Romane* Territory; which no doubt he preferred before all parts of *Europe*. Notwithstanding this generall inclination of mankind to perfect their dwelling places for their better ease and comfort, we shall finde many waies whereby the parts of the Earth haue degenerated, & proued more unfit for humane habitation then in former times. The first which is the greatest, and cause of all the rest, is that *Curse* which our Almighty Creatour cast on the whole Earth for *Adams* sake, which after ward seemes renewed and increased in the generall deluge, wherein all mankind suffered for their sinnes a plague of waters. For as the estate of mankind immediatly before the *Flood*

was

was farre better then that afterwards, so was the estate of *Paradise* farre better then that : So as wee may note from the beginning of the world a generall defect and weaknesse of the Creatures, still more and more declining from their originall perfection granted in the first creation. So that many great Philosophers haue coniectured, not without ground, that the world from the first creation hath suffered the change of ages sensibly, and this wherein we liue to bee the last and decrepite age, wherein Nature lieth languishing, as ready to breath out her last. But this opinion seemes to be controled by reason; forasmuch as we finde not a proportionall decrement and defect of naturall vigour in things, as well in man as other creatures. For if we compare the estate of a man before the Flood, with the age of *David* long after, we shall finde a great disparity in the proportionall decrement of the *Yeares* and *Ages* of men: forasmuch as many before the Flood attained to 800, & some as *Methusalem*, to 900 yeares: But in *Dauids* time, the daies of mans life (as he himselve testifieth) are threescore and ten: & admit we vnderstand this speech of *David* to be meant onely of his chiefe strength and liuelihood, we shal yet finde a great diuersity, because man is vnderstood to bee in his greatest strength and vigour in his middle age; so that the whole age of man by this account surmounts not 140 yeares. To which proportion of defect or decremet our times can no way agree, because many men in our daies come neere the same age, as we see by experience, which may be confirmed by diuerse instances, whereof we will produce only two: the one of a certaine *Indian* presented to *Soliman* the *Turke*; being of the age of 200 yeares: the other of the Countesse of *Desmond* in *Ireland* (which *S^r Walter Rauleigh* mentions to this purpose) who was married in *Edward* the fourth's time, yet was aliue very lately. But to this doubt I might answere, that this extraordinary difference betwixt the ages of men, between the *Patriarchs* & *Dauids* time compared with men, ages betwixt *Dauids* and our daies, came from two especiaall causes: First by the vniuersall *Deluge*, which caused a generall defect and decay of nature in the whole earth, the like whereof hath not since bin found:

B

Secondly

Secondly, it was (as it seemes) much impaired by the *Intemperance* and luxurious diet of those times, which added much to this generall weaknesse of nature: forasmuch as the children can haue little or no naturall perfection in themselves more then is deriued vnto them by their parents. For nothing can giue that to others which it neuer had it selfe; whence it must needs come to passe, that the posteritie deriued from luxurious and distempered bodies, should proue as weake and impotent generally (if not more) then their Parents. Now why the people soone vpon the Flood should finde their distemperature more noxious and preiudiciall to long life then the men of our age, a good reason may be giuen; because the Earth long after the Flood had not fully receaued that naturall heat & spirit which it lost in the *Deluge*. So that all things arising out of it; as *Plants, Hearbs, Fruits*, and liuing creatures feeding thereon, proued for a while more vnwholsome and vnnaturall, then in some yeares after, when it had somewhat reuiued it selfe by the heat of the *Sunne* and the *Starres*, & by little & little returned to his owne nature. The other cause of deficiencie is more speciall, as not happening to all, but to diuerse parts of the Earth, and that more at one time then another: as the neglect of due manuring many places, caused commonly two waies; either by contagion naturally incident to diuerse places, or by hostile *Invasion* and devastation: of this latter arise two maine effects; The first is the want and scarcity of Inhabitants, which should dresse and manure the ground to make it more fruitfull and accommodate to mans vse. The second is their *poverty* and *captivity*; whereof the one makes them vnable, the second vnwilling to effect any great matter for the benefit of the Land. A good instance whereof we may finde in the land of *Palestine*; which in times past by God himselfe was called, *A land flowing with milke and hony*, for the admirable pleasantnesse & fertilitye of the Soile: yet at this day, if wee will credit trauellers report, a most barren Region, deuoid almost of all good commodity fit for the vse of man; in the ruines of which sometimes famous kingdome, euery bleare-eyed iudgement may easily read Gods curse long since denounced; Which strange alteration

teration next vnto Gods anger we can ascribe to no other cause then the hostile inuasion of forraine enimies, which hath almost left the land waste without the native Inhabitants; whence it could not chuse in a short time but degenerate from the ancient fruitfulnessse. The like may we finde in all those miserable Regions which groane at this day vnder the tyrannie of the vnsurping *Turke*: whence a prouerbe runnes currant amongst them: *That where the Turkes horse hath once grazed, no grasse will euer after grow*: which signifies no other then the barbarous manner of the *Turkes*, hauing once conquered a land, to laie it open euer after to deuastation: for being for the most part warlike men trained vp in martiall discipline, they little or nothing at all regard the vse of husbandrie: whence in short time a Countrey must needs turne wild and vnfruitfull. To these causes we may adde the influence of heauenly constellations, which being varied according to the times, produce no small effects in the changes and alterations of the Earth. The diuerse alteration in the disposition of the Inhabitants which was our second point, we haue reserued to another place neare the end of this tract, to which it properly appertaines.

3 *Places hauing long continued without habitation are seldome so healthie and fit for dwelling as those which haue bene inhabited.*


This Proposition I haue knowne to be warranted by the Testimonie of many experienced Nauigators: insomuch as I presume few men can doubt of the truth of it, which hath either beene a Traueller himselfe into farre Countreies, or at least hath read other mens discoueries. The onely matter therefore wee here intend, is to produce certaine causes of this effect, to giue satisfaction to such as make a distinction betwixt the knowledge of the effect, and inquiry of the cause. The first cause which I can alledge is the industrie of mankind inhabiting any Countrey (mentioned in the former Theorem) out of which ariseth a twofold effect. 1 The improuing of the Soyle, by removing all such impediments as otherwise would proue noisome to mankind, for whereas all things growing of their

owne accord, are suffered to rot into the ground in like man-
 ner, what other can we expect but Fennes, Fogges, & noisome
 vapours, altogether hurtfull to the welfare and life of man.
 2 The profit of mans industrie is no lesse apparent in manu-
 ring the ground, & opening the vpper face of the Earth: which
 being composed of diuerse substances, sendeth forth many
 times certaine hot fumes and vapours, which in many cold
 Countries mollifie the vsuall rigour of the Aire, which most
 offends the Inhabitants. This reason is given by my Countri-
 man Captaine *Whitborne* for the extreame cold, which some
 men professe themselves to haue tried in *New-found-land*,
 which neuerthelesse, according to many mens description, is
 knowne to lye farre more South then *England*: for the natives
 of the Country being for the most part driuen into the North
 part by the *Europeans*, who vsuall trade there for fish, and
 they themselves liuing altogether on Fish from the Sea, or
 some wild beasts on the land, as *Beares*, *Deare*, and such like;
 without any manuring of the ground for herbage; The Soyle
 by them is in a maner left altogether vnmanured: so that nei-
 ther the soyle can be well cleansed from noisome vapours ari-
 sing from the putrefaction of herbage rotting (as I said) into
 the ground, or left free to send out such wholesome fumes and
 vapours from its interiour parts, which may warme the Ayre,
 and preserue mankind. 3 A third reason drawn from mens In-
 dustries, that those Countries which haue inioyed Inhabitants
 by the continuall vse of *Fires*, haue their Aire more purged and
 refined from drossie and noisome vapours, which vsuall arise
 out of a contagious soyle, daily infected by putrefaction: for
 scarce any nation hath beene knowne so barbarous & ignorant
 which hath not the inuention and vse of Fire: neither is any in-
 fection of the aire so pestilent, and opposite to humane consti-
 tution, which the breath of fire will not in some sort dispell. If
 any man obiekt the distance of houses & villages wherein fire is
 vsed, which seeme to claime a small interest in the change of the
 ayre hanging ouer a whole Country: let him well consider the
 quicknesse of motion and fluidity of the Ayre, passing (as it
 were) in a moment from one place to the other, and he may
 soone

soone answered his owne objection. All those reasons hether^o mentioned an inhabited Region owes to mans industrie, which we generally touched in the precedent Theoreme. The second cause which is as a consequent of habitation, is the necessitie of breathing of people living in any Region of the Earth: whereby may follow two effects. 1 A certaine measure of heat impressed into the aire, as we see in any roome in a great throng of people, by reason of their breathing together in one place. 2 The assimilation of the Aire to humane bodies, by a continuall respiration. These alterations of the aire, might perhaps to common apprehensions, seeme small and insensible. But hee that considers how great a quantitie of aire is requisite for a mans respiration, and the space and extent of motion together with the multitude of Inhabitants in a populous Countrie, would hold it no strange matter, that the breathing of men should breed such an alteration of the aire: we finde by experience, that strong built houses being left tenantlesse, wil soone fall into decay, not so much for want of reparation, as the foggy vapours and moisture, caused by want of Respiration. The like whereof in some proportion may we imagine to be in a region wanting Inhabitants, and deprived of this benefit of nature.

C H A P. II.

Of the Generall Adiuncts of Places.

- 1:  N a place Topographically taken two things are to be considered. 1 The *Adiuncts*. 2 The *Descriptions*. The *Adiuncts* are such proprieties as agree to speciall places.

2 Such

- 2 Such Adiuncts agree to a place, either in respect of the *Earth* it selfe, or in respect of the *Heavens*: Those which agree to a place in respect of the *Earth*, are either *Internall*, or *Externall*.
- 3 The Internall I call such as are inbred in the *Earth* it selfe: which are of two sorts; either *Common*, or *Magneticall*.
- 4 The Common are in number three. 1 The *Magnitude*, or extent of a Countrey. 2 The *Bounds*. 3 The *Qualitie*. The *Magnitude* comprehends the Length and Breadth of any Region.

Some man might imagine that I make a needlesse repetition of these proprieties: forasmuch as many of them seeme to haue beene spoken of before in our *Sphericall* part. But I answer, that I there handled no other matters, but such as concerned the whole globous body of the *Earth*. But my intent here is to treat of such proprieties, as particularly designe out a speciall place. For it is not one thing to speake of the *Magnitude* of the whole *Earth*, according to all its dimensions; & to treat of the manner of measuring some particular Region, marked out in the Spheare. We haue defined the *Magnitude* of a Region to be either of *Length* or *Breadth*: because (as wee haue taught in our former chapter) it is a space contained in the surface of the *Earth*. Then can it not according to Geometricall grounds, exceed two Dimensions: These two Dimensions (as we haue said) are length and breadth, whereof euery plaine figure, or superficies consists.

- 5 The *Magnitude* of a Region may be measured

fured two waies: either by the *Diameter*, or the *Circumference*. The *Diameter* is considered either in Latitude or Longitude: of the Latitude, whence ariseth the Breadth of a Country from North or South, note these Rules.

- I If the place whose breadth is sought, bee distant from the *Æquatour*, and be wholly situat in the same Hemisspheare, the lesser Latitude subtracted from the greater will giue the *Diameter*.

To put this Rule in practise, it behooues the Topographer, who would finde out the greatnesse of any Region, to obserue two Latitudes: to wit, to measure the Latitude in the most Northerne point, where it is greatest: as also in the Southerne point, where it is least of all. This latter subducted from the former, will giue the *Diameter* or breadth from North to South: which may easily, according to the Rules in the former booke, be reduced into Miles, or other such measures. For an example we need goe no farther then our Iland of *Great Brittain*: The Southmost part of which lying about *Star-point* in *Deven*, hath in Latitude about 50 degrees: The Northermost point situate neere the mouth of the riuer *Ardurnus* in the farthermost part of *Scotland*, hath in Latitude about 60 degrees (to omit minutes) The lesser of these Latitudes subtracted from the greater, the residue will be 10 degrees, which being imagined in the Meridian which is a greater circle, are to be multiplied by 60, and so conuerted into Miles, which will be 600, the length of *Britany* from South to North.

- 2 If the place whose Magnitude we enquire, be vnder the *Æquatour*, the Southerne Latitude added

added to the Northerne will shew the breadth
from the North to the South.

To illustrate this by an example, we will take the whole continent of *Africa*, whose Southerne Latitude about the Cape of *Good hope*, we shall finde to be neere thirty Degrees: the most Northerne Latitude about the straights of *Gibraltar*, very neer the same rate: These two summes added together will amount to 60 Degrees, which multiplied by 60, the number of miles answerable to a degree in a great circle (because we suppose it here to be an Arch of the Meridian) we shall haue 3600 miles, the breadth of *Africa* from South to North.

4 The measure of the length of a Region betwixt East and West, admits of two cases: for either the Country is supposed to bee without the first Meridian, or vnder it: both which shall be taught in these Rules.

I If the Region be situate without the first Meridian, the lesser Longitude subtracted from the greater, will shew the Diameter betwixt East and West.

For an example of which we will take *Cape de Barca*, lying ouer against *S. Thomas* Island in *Africa*, vnder the Equatour, whose Longitude is about 30 Degrees, and *Melinde* situate neere the Equatour ouer against *Sinus Barbaricus*, on the other side of *Africa*, which hath in Longitude 63 Degrees. The least Longitude, to wit 30, being subducted from 63, there will remaine 33 Degrees; which being taken in a greater circle, which is the Equatour, or a Parallell very neere (which admits no sensible difference) we multiplie by 60, and there will arise 1980 *Italian* miles, but if the Degrees bee taken in one of the lesser Parallels, we must proceed according to the Table of miles answerable to Degrees of Latitude in the former booke.

Another

7 Another Case is when the place is situate vnder the first Meridian: The length & measure of such a Region is found out by this Rule.

- 1 Let the Westerne Longitude be subtracted out of the whole circle, and to the Residue added the Easterne Longitude, the summe will giue the greatnesse and distance betwixt East and West.

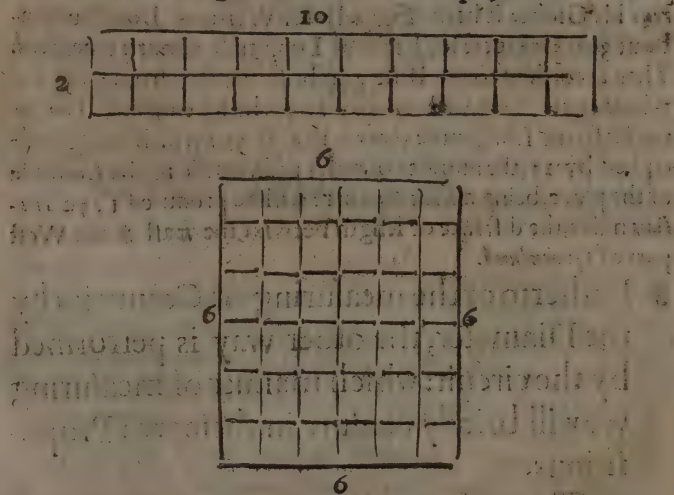
For an instance we will take *Greenland*, supposed in most of our Globes and Mappes, to be an Iland which is set down directly vnder the first Meridian, passing by the *Azores* in *Kearrys* his Globe: It hath assigned it for Westerne Longitude about 340 Degrees: for Easterne Longitude about 30 degrees. Then according to our Rule 340 be subtracted from 360, the whole circle, there will remaine 20, which being added to 30 the Easterne Longitude there will arise 50: which being multiplied by 25, the number of miles answerable to the Latitude of the place, being about 65, there will be produced 1250 *Italian* miles, the distance or length betwixt the East & the West part of *Greenland*.

8 Hitherto of the measuring of Countries by the Diameter; the other way is performed by the circuit: which manner of measuring we will briefly censure in these two Propositions.

- 1 The measuring of any Country by the Circuit of it, is very deceitfull and full of errors.

It hath beene a common custome amongst Navigateurs to iudge of the greatnesse of any Country, by sayling round about

bout it; which kind of measuring is not alwaies to be reiect^d forasmuch as in new discoueries sometimes no other way can be had. Neuerthelesse this manner of measuring must needs proue very vncertaine for diuerse reasons. First in regard of the motion of the ship, which by reason of diuerse and contrary winds, which must needs happen very frequently, cannot alwaies moue with the same swiftnesse. Secondly because the Sea it selfe (as we shall hereafter shew) hath in diuerse places diuerse speciall motions and currents, as from the East to West whence it must needs inforce an inæquality of motion in the ship. The third reason, which is greater then all the rest, is drawn from the various *Figuration* of Countries, whose greatnesse cannot be knowne by the circumference. Because (as *Geometricians* teach vs) two figures may haue one & the selfe same circuit about them, and yet the one shall extraordinarily exceed the other in greatnesse: as for example, let there be ima-



gined two *Parallelogrammes*; the one an exact square of six foot; the other a long square of 10 foot in Length, and two in Breadth. The one comprehends 36 square feet, the other 20,

as will appeare by multiplication of their sides, the one into the other: in which numbers there is a great inequality. Yet notwithstanding if we measure the circuit or circumference of each Figure, we shall finde them equall, to wit, of 24 foot, as will appeare by their figures here prefixed. For amongst those Figures called *Hoperimetrall*, or of equall Perimeter, that is alwaies to be esteemed the greatest, which is the more *Ordinate* figure: which is that, which commeth nearest to an equality of *Sides* and *Angles*. But in *Inordinate* Figures (of which nature for the most part are all Regions) infinite error may be committed, if we measure them by circumnavigation: wherefore to measure a Country more exactly it behooveth vs not only to knowe the *Circumference*, but also the *Diameter*.

2 *Those Countries are more exactly measured which partake of a plaine surface.*

The reason of this Proposition is easily shewed, because a *plaine Superficies* consists of right lines. But a right line (as *Euclide* witnesseth) is the shortest betwixt his owne bounds: whereas betweene two points infinite crooked lines may be drawne: whence it must needs follow, that more certainty and exactnesse is to be expected in the measure of a *Plaine* Country whose *Diameter* is a *Right* line; then from a *Crooked* and hilly trey, Region, where the *Corde* is crooked and gibbous. Whence some *Mathematicians* have demonstrated, that more men may stand on a *Sphaericall Superficies*, as a Hill or mountaine, then on a *Plaine*, although both are found to be of the same *Diameter*. It may be here objected, that the earth is every where crooked and orbicular, & therefore no part thereof can be measured by a *Right line*: I answer that the Earth is indeed *Sphaericall* (as we have formerly proued) yet may some little part or portion thereof be counted as a *Plaine*; because such parts haue little or no proportion to the whole masse of the Earth. This convexity therefore being so little, may passe for a plaine without any sensible error. Hence wee may gather that the Land cannot so exactly be measured as the Sea. Forasmuch as the land for the most part is vneuen, varied with hills,

Dales, and other inequalities. But the Sea euery where plaine and like it selfe, except the rising of the waues & surges, which in so great a distance will make no difference at all. Secondly, we may hence collect that of two Countries of the same bounds and figure, that must be the greatest whose soyle and superficies is most varied and crooked: because. (as wee haue said) crooked lines betwixt the same points are longer then right, and therefore measure the greater Magnitude.

9. Thus much of the Magnitude. The *Bound* of a Country is a line compassing it round.

This definition is very eident, in that every Region is *Topographically* considered as a *Plaine* or *Superficies*, whose bound is a line compassing it round: for, as a *Line* is bounded by a *Point*, so a *Superficies* by a *Line*, as we are taught in *Geometry*. Now we must consider that the bounds of Countries may be taken two manner of waies: First *Geometrically*, for the mere line, which is imagined to goe round about it: Secondly, *Geographically*, for the visible marks and Characters, whereby the line is traced out vnto vs, such as are *Rivers*, *Cities*, *Hills*, *Castles*, and such like. These marks whereby a *Topographer* noteth out vnto vs the bounds and limits of Countries, are of two sorts; either *Naturall* or *Artificiall*. The naturall are such as are deriued from nature without mans appointment, such as are *Rivers*, *Creekes*, *Mountaines*, *Woods*, & such like other matters, which bound the extents of Countries. The Artificiall bounds are such as depend vpon some constitution or decree of a man, which so divide one Country from another: the partition being often made where no notable marke or bound is set by nature.

1. *Naturall bounds are more certaine then Artificiall.*

The reason is because naturall signes or marks which are set for bounds of Countries are alwaies the same, and (as it were) continued from the first creation: and cannot be changed without some great *Earthquake*, *Inundation*, or such like alteration

in

- in nature, which very seldome happeneth, and in very few places: whereas on the contrary part, such bounds and limits, as depend vpon mans appointment, may be altered and changed according to the wills and dispositions of men: as we daily see amongst vs, that ancient lands and inheritances are much questioned concerning their bounds and limits: as also great controuersie is made amongst Geographers concerning the bounding of Countries and Territories, anciently knowne and defined by old writers: For names and particular contracts betwixt men in a few ages, may easily slip out of memory; especially when the possessours themselves (as it often happens) strue to extinguish and raze out the memory of former ages, leauing behind them no marke or signe to tell the world their wronged neighbours right, or the limited fortunes of their owne possessions.

2 *Aequall bounds doe not alwaies containe aequall Regions.*

This Proposition is plainly demonstrated before in this very Chapter: wherein wee haue proued of two figures supposed aequall in the circumference, that to be the greatest, which more neerely approacheth an *Ordinate* figure: which wee define to be that which commeth neereft to an equality of Sides and Angles. So that two Regions, the one round, the other square, may haue an aequall compasse about, and yet the former will be a great deale greater, in respect of the space therein contained.

10 In the next place we are to consider the Quality. By the quality I vnderstand the naturall temper and disposition of a certaine place.

1 *Speciall places are endowed with speciall tempers and dispositions.*

That Almighty God, who created the whole world, hath not granted

John Birch 1772

Spencer

John

granted the same gifts and indowments to all Countries, but hath diuided diuerse commodities to diuerse Regions, seemeth a matter out of all controuersie. For who findes not by experience one Country *hot*, another *cold*, a third *temperate*: one *fruitfull*, another *barren*, a third *indifferent*, one *healthie*, another *unwholsome*. The like diuersitie is also found in the Inhabitants themselves, according to that common prouerbe: *Valentes Thebani, Acutiores Attici*: whence this diuersity should arise, it is a hard matter to vnfold; forasmuch as many causes herein concur, sometimes to helpe, sometimes to crosse one the other: yet will I strue as neere as I can to reduce them to certaine Heads, by which a generall guesse may bee giuen to the particulars. The first reason may bee drawne from the situation of the Earth, in respect of the heauen & Starres therein fixed. This may cause a diuersitie of disposition two waies; 1 By reason of the Sun, and his generall light & influx: whence in the Earth are ingendred the foure first qualities of Heate, Cold, Drouth, and Moisture, whereon depends a great part of the disposition, not only of the soyle, but also of mans body: forasmuch as the one ordinarily borrowes his fruitfulness or barrenness of these first qualities: and the other hath his vitall Organes (which are the ministers of the Soule) much affected with them; insomuch as some Philosophers haue vndertaken to define all the differences of mens wits and intellectuall faculties out of the Temperament of the braine, according to these foure accidents. And what Physitian will not acknowledge, all these Qualities and their mixture to challenge an extraordinary preeminence in the disposition and constitution of mans body, whose mixture is the first ground of health or sickness. The second meanes whereby the Heauens may cause a diuersitie of Temper in diuerse places, is from the *Speciall Influences* of some particular Starres and constellations incident to particular places: for it were blackish to imagine that so many various Starres of diuerse colours & magnitudes should be set in the Firmament to no other vse then to giue light to the world, and distinguish the times: sith the ordinary Physitia can easily discouer the Moones influence by the increase of humours

mours in mans body: and the experience of Astrologers will warrant much more by their obseruation; as assigning to each particular aspect of the Heauens a particular and speci all influence and operation. Now it is euident that all aspects of the Heauens cannot point out and designe all places alike; forasmuch as the beames wherein it is, conveyed, are somewhere perpendicularly, other where obliquely darted, and that more or lesse according to the place: whence it commeth to passe that neither all places can inioy the same Temperament, nor the same measure and proportion. Yet wee say not that the heavenly bodies haue any power to impose a *Necessitie* vpon the *wills* and dispositions of men; but only an inclination: For the Starres worke not Immediately on the intellectuall part or minde of man, but Mediatly, so farre forth as it depends on the Temperament and materiall organes of the body. But of this we shall especially speake hereafter. Where (God willing) shall be opened the manner of this celestiaall operation. By this we may vnderstand how farre the Heauens haue power to cause a diuersitie in Places and Nations. The second reason may be the *Inbred Qualitie, Figure, and Site* of the Places themselves; For that there is another cause of diuersitie besides the situation of places in respect of the Heauens, may easily be proued out of experience; for we finde that places situate vnder the same Latitude, partake of a diuerse and opposite Temper & disposition, as the middle of *Spaine* about *Toledo*, which is very hot and the Southermost bound of *Virginia*, which is found to be Temperate betwixt both: All which notwithstanding are vnder the selfe same Latitude, or very neere, without any sensible degree of difference: also we sometimes finde places more Southward toward the Equatour to partake more of cold, then such as are more Northerne, as the Toppes of the *Alps* being perpetually couered with Snow, are without question colder then *England*, although they lie neerer to the æquinoctiaall. Likewise *Aluarez* reporteth that he saw Ice vpon the water in the *Abyssine*s Countrey in the month of Iuly, which notwithstanding is neere or vnder the Line. And *Martin Frobisher* relates, that he found the ayre about *Friesland* more cold & stormy.

stormy about 61 degrees the in other places neere 70 degrees. Wherefore we must needs ascribe some effect and operation to the soyle it selfe: first in respect of the *Superficies* which is diuersly varied with *Woods*, *Riuers*, *Marshes*, *Rokes*, *Mountaines*, *Valleys*, *Plaines*: whence a double varietie ariseth: first of the foure first *Qualities*; which is caused by the *Sunne-beames* being diuersly projected according to the conformity of the place: Secondly of *Meteors* and *Exhalations* drawne vp from the Earth into the Aire: both which concurring must needs cause a great varietie in mans disposition: according to that proverbe, *Athenis tenue calum*, *Thebis crassum*: or that bitter taunt of the Poet on *Beotians*, *Beotum in crasso iurares aëre natum*. For ordinary experience will often shew that a thinne & sharp ayre vsually produceth the best witts; as contrariwise grosse and thicke vapours drawne from muddie and marshy grounds thicken and stupifie the spirits, and produce men commonly of blockish and hoggish dispositions and natures, vnapt for learning, and vnfit for ciuill conuersation. Secondly, there must needs be granted to speciall Countries, certaine *Specificall* qualities, which produce a certaine *Sympathie*, or *Antipathie* in respect of some things or others: whence it commeth to passe that some plants & hearbs, which of their owne accord spring out of the Earth in some Countries; are found to pine and wither in others: some Beasts and Serpents are in some places seldom knowne to breed or liue, wherewith notwithstanding other Regions swarme in abundance: as for example, *Ireland*, wherein no Serpent or venomous worme hath bene knowne to liue; whereby *Africa* and many other Countries finde no small molestation. Neither is this variety only shewne in the diuersity of the kinds, but also in the variation of things in the same kinde, whereof we might produce infinite examples. For who knowes not, which is a Physition, that many simples apt for medicine growing in our land, come farre shorter in vertue of those which are gathered in other countries. I need amongst many ordinary instances giue no other then in our *Rubarb* and *Tobacco*: whereof the former growing in our Countrie, except in case of extremitie, is of no vse with our *Physicians*: the other

as much scorned of our ordinary Tobacconists: yet both generally deriued from the true mother the *Indies*, in great vse & request. But of this last Instances are most common, and yet for their ignorance of the true cause, most admirable. The causes of the former might in some sort be found out either in the Heauens, or in the Elementary nature of the Earth. But some speciall proprieties haue discovered themselues, which cannot be imagined to owe their cause to either, but to some third originall, which the Physicians in their Simples more properly rearme *virtus specifica*. If any man should demand why countries farther from the course of the Sunne should be found *hotter*, then some which are needier? Why the *Rhenish* wine Grape transported from *Germany* into *Spaine*, should yeeld vs the *Sherry Sack*? Euery ordinary Philosopher, which hath trauelled little beyond *Aristotles Materia Prima*, will be ready to hammer out a cause, as ascribing the former to the Heigth or Depression of the soile: the latter to the excesse of heat in *Spain* about that of *Germany*. But should we farther demand, 1 why *Ireland* with some other Regions indure no venomous thing. 2 Why Wheat in *S. Thomas* Iland, should shut vp all into the Blade, and neuer beare graine? 3 Why in the same Iland no fruit which hath any stone in it, will euer prosper? 4 Why our Mastiffes (a seruiceable kinde of creature against the molestation of Wolues, and such hurtfull beasts) transported into *France*, should after a litter or two degenerate into Curres, & proue altogether vs seruiceable? 5 Why with vs in *England*, some places produce Sheep of great stature but course wooll; other places small Sheep, but of very fine wooll: which being naturally transplanted, will in a generation or two so degenerate the one into the others nature, that the greater Sheep loose somewhat of their greatnesse, yet improve their fleeces; as the other increase their stature, but loose much in the finenesse of their wooll? 6 Why many places at the ridge of the mountaines *Andi* in *America* cannot bee passed ouer without extreame vomiting and griping euen vnto death. 7 Why a River in the *Indies* should haue such a nature to breed a great long worme in a mans leg, which oftentimes proues mortall

vnto the patient, with infinite the like examples found in Geographers, concerning the nature and accidents of *Fountaines, Hearbs, Trees, Beasts*, and *Men* themselves (as wee shall shew hereafter) so much varied according to the disposition of the soyle, what wiser answer can an ingenious man expect then silence or admiration? for to make recourse to *Sympathies, Antipathies*, and such hidden qualities with the current of our philosophers, is no other then in such sort to confesse our own ignorance, as if notwithstanding, wee desired to bee accounted learned: for beside the difference of the tearmes wherein euery Mountebanke may talke downe a iudicious Scholler; I see no aduantage betwixt a Clowne which saies he is ignorant of the cause of such an effect, or of a iuggling Scholler which assignes the cause to be a sympathie, antipathie, or some occult qualitie. I speake not this to countenance supine blockishnesse, or to cast a blocke in the way of curious industrie. The former disposition I haue alwaies bated, and the latter still wished in my selfe, and admired in others. Al which I can in this matter propose to a curious wit to be sought, must be reduced to one of these two heads: for either such admirable effects as wee haue mentioned, must arise from some *Formall* and *Specificall* vertue in the soile, or from some extraordinary Temperament made out of a rare combination of the Elements, and their secondary mixtures, as of *Hearbs, Stones, Mineralls*, and vapours arising from such, and affecting the Aire: of both which wee shall haue some occasion to treat in the parricular Adiuncts of places; yet so, as I feare I shall neither giue my selfe content, or my Reader any sufficient satisfaction. But *In magnis voluisse sat est.*

II Hitherto of the commo inbred Adiuncts of the Earth Topographically taken: Next we will speake somewhat of the *Magneticall* Affections of a place: These are in number two, viz: *Variation* and *Declination.*

We haue in our former Treatise of the *Magneticall* nature of the Earth handled diuerse other affections, growing from the Magneticall Temper and disposition of the terrestriall Globe: whence some man might here collect this repetition to bee altogether needlesse, or at the least imperfect, omitting many other of the Magneticall Affections. To this I answer, that it is one thing to speake of these Affections as they agree to the whole Spheare of the Earth: Another thing to consider them, as they are particular proprieties, and markes of particular places and Regions. In the former sort haue we besides the Variation and Declination handled many other affections of the Earth magnetically considered. We here only speake of these two, as they are speciall markes and proprieties of speciall places: which it behooues a *Topographer* to obserue as a matter worthie observation in the description of any place. The vse shall be commended vnto vs in these two Theorems.

I *The Magneticall Variation is of no vse for the first finding out of the Longitude; yet may it serue to good purpose for the Recognition of a place heretofore discovered.*

The reason of this we haue shewne in our former booke; because the variation seldome or neuer answers proportionally to the Longitude, as some of the ancients on false grounds haue surmised: whence no true consequence can bee drawne from the variation of a place to the finding out of the Longitude; yet may it be of speciall vse for the new finding out of such places as haue formerly by others bene first discovered, so the variation were first by them diligently and faithfully noted and obserued: first because few places in the Earth can exactly and precisely agree in the selfesame variation; but in some Degree or minute will be found to varie. Secondly, if any two places should be found to accord in the same Degree of *Variation*; yet comparing the variation with the degree of *Declination*, wee shall commonly finde a difference: forasmuch as places agreeing in variation, may notwithstanding varie in the Declination.

D

Thirdly

Thirdly, if two places should be equalized in both (as we cannot denie it to be possible) yet the comparing of these two Magneticall motions with other affections, as well in respect of the Earth it selfe as of the Heauens, will giue at least a probable distinction: of which cases it is not hard out of the obseruations of our new writers and Nauigatours to giue particular instances. Concerning the *first*, we finde the variation of the compasse at *Cape Verde*, to be iust 7 Degrees; about the Ilands neere to *Cape Verde* to amount only to 4 Degrees; whence a Sea-man (if other helps failed) may hereafter, as hee passeth, distinguish the one from the other, and if occasion serue, correct this error. In the like sort might a man (otherwise altogether ignorant of the place) out of former obseruations, in the same Island of *Cuba* distinguish betwixt *Cape Corientes* and *Cape S. Anthony*; In that the one hath only 3 degrees of variation, whereas the other hath 13: for an instance of the *second case* we will take the coast of *Brasil* 100 leagues distant from the shoare, and *Cape Corientes* beyond *Cape bona spei*, which agree in the same variation: to wit, amounting to 7 Degrees 30 minutes: which notwithstanding are distinguished by their seuerall variations: for howsoever the magneticall motion of variation being of late inuented, hath not so particularly bene traced out in all or most places, yet must the declination of each place needs be different; forasmuch as the former hath 23 degrees of South Latitude, the other none at all, lying iust vnder the *Æquinoctiall*: since the Latitude (as wee haue formerly taught) is in some measure proportionall to the Declination. For the third, if any two places be found agreeing both in *Variation* and *Declination*, as may be probably guessed of *Cape Rosse* in *S. Johns* Island, and the West end of *S. Iohn de Porto Rico*: the Latitude being all one as of 17 degrees 44 minutes: and the variation admitting perhaps insensible difference, to wit, of a little more then one degree: yet might this helpe conioined with former Trauellers report, or some small obseruation of heauenly bodies, or sounding the bottome of the Sea, settle our opinion and make a plaine distinction.

2. *The Declination of any place being knowne the Latitude may also be found out, although not without some error.*

The ground of this Assertion we haue formerly handled in the Treatise of the Magneticall Affections of the Earth; where we haue shewed that the Declination of the Magneticall needle is alwaies answerable in some proportion to the Latitude of the place: whence it must needs follow, that the declination any where being found out together with the proportion, the Latitude must needs be knowne. In this point I referre my Reader to D. *Ridley's* late Treatise of Magneticall bodies & Motions, wherein he by the helpe of M. *Briggs*, hath calculated a certaine brieftable for this purpose. But that this manner of Inuention of the Latitude of a place, must needs admit of some error, cannot well be denied; forasmuch as *Gilbert*, *Ridley*, & others, which haue written of this subiect; haue acknowledged this motion of Declination to be in many places irregular, and not answerable in due proportion to the Degrees of Latitude, which diuerse friends of mine, well experienced in magneticall experiments, haue to their great wonder confessed.

12. This much for the *Internall* Adiuncts:

The *Externall*, I call such as are not imprest into the Earth, but externally adjacent or adioyning vnto it. Here ought we to consider the *Aire* adioyning to any place with his Qualities and Proprieties.

13. The Ayrie properties of a place consist in such matters, wherevith the Ayre according to diuerse places is diuersly affected and disposed.

In the Ayre we ought to note a twofold temper and qualitie;

the one *Inbred* and *Essentiall*; the other *Externall* and *Accidental*, The former, whether it be heat ioined with moisture, as *Aristotle* affirms, or cold ioined with moisture, as some others, I leaue it to the Naturall Philosopher to dispute. The latter being that to which our purpose is chiefly inaged, and that no farther then may appertaine to the Topicall description of a speciall Country. These accidents being so various and many, we are inforced to reduce them to a few generall heads which we will couch in this our Theoreme.

I *The disposition of the Ayre adjacent to a place depends chiefly on the Temperament of the Soyle.*

Those things wherewith the Aëriall Region is affected, are of two sorts; to wit, either the *Temperament* consisting in the mixture of the 4 first *Qualities*; or else the bodies theselues, as *Meteors* drawne vp into the Aire, whereof these accidentall dispositions arise. That both these chiefly depend from the *Temperament* of the Earthly Soyle of a certaine place, many reasons will demonstrate: first that *Meteors*, whatsoeuer they are take their originall from the Earth, is plaine. 1 Out of the name, which signifies things lifted vp, to shew that a Meteor is lifted and drawne out of the Earth. 2 Out of the materiall composition, which can no where else take this composition: For either we should deriue it from the *Heauens*, or from the *Ayre* it selfe, or from the *Fire*: From the Heauens it cannot take originall; because it is corruptible, and therefore of no heauenly substance according to *Peripatetick* Philosophie. Not from it selfe, because the aire being supposed a simple and vncompounded body, cannot admit of such mixture. Not from the *Fire*; first because all *Meteors* partake not of fierie nature. Secondly, because fire cannot well subsist, but of some matter whereon it may worke, and conserue it selfe, which can be no other then that which is of a glutinous substance; which we nowhere finde but in the earthly Globe, consisting of Earth and *Water*; out of whose store-houses, the matter of all such pendulous


dulous substances in the aire is deuied. These Meteors may be deuied from the Earth into the Ayre two manner of waies. First, *Directly* and immediately, by an immediate ascent or rising of exhalations from some one particular place into the Ayrie space right ouer it. Secondly, *Obliquely*, to wit, when Vapours, or other such exhalations are by some violence or other carried from one place into another: as winde, which being ingendred in one place, continually bloweth into another. Againe, the former may happen two waies: for either this rising of Exhalations out of the Earth, is *Ordinary*, or *Extraordinary*: Ordinary I call that whereby the thinne parts of the water or Earth are continually spread and diffused through the whole Region of the Ayre: for we cannot imagine otherwise then that at all times and places, the Terrestriall Globe composed of Earth and Water; continually sends and euaporates out some thinne or rarified parts, wherewith the earth is affected. Whither this Rarefaction or Euaporation of the water be the true substance of the Aire it selfe (as some haue probably coniectured) or else some other body different from it, I will not here dispute. This much will necessarily follow, that it proceeds originally from the Earth right vnder it. This vapour being ingendred from the water or moister parts of the Earth, is much varied and temper'd according to the place from which it ariseth: For the matter of the Earth being various & diuers in disposition, as well in regard of various veines of minerall substances, whereof it consists, as of the first and second qualities thereof arising, must of necessitie cause the Aire about each Region to be of the same qualitie. Whence a probable reason may be shewne; why of two places, although both like in respect of the Heauens, and other circumstances, one should be hot, the other cold; one healthie, another contagious; the one of a sharpe and thinne aire, the other of a foggy & dull temper: For no question but the minerall matter whereof the soile of the Earth consists, being not euery where Solid and hard, but euery where intermedled with a vaporous & fluide substance, must needs challenge a great interest in the Temperament of the Ayre, as that which is the first mother, if not of
the

the Aire it selfe, yet at least of the accidentall dispositions there of. The *Extraordinary* evaporations I call such as arise out of the Earth by some extraordinary concurse of the Sunne, with some other Starres. These are many times subiect to sense, which happen not at all times and places: such as are clowdes, windes, and such like, which arise not naturally by their owne accord by a perpetuall emanation, but are by some greater strength of the Sunne or Starres rarifying the parts of the earth or water drawne vp to the Aire about it. Now for the Meteors *Indirectly* and obliquely belonging to any place, amongst many other instances, we may bring the winde which bloweth from one Region to another; which according to ordinarie experience partaketh of a twofold qualitie; the one deriued from the place whence it is ingendred; the other from the Region through which it passeth. Which may appeare by our foure Cardinall windes, as they are with vs in *England, Belgia, and higher Germany*. For first our Easterne winde is found to bee driest of all others, whereof no other cause can be giuen, then that it comes ouer a great Continent of land lying towards the East, out of which many drie & earthly exhalations are drawn: so the Westerne winde is obserued to be very moist, because it passeth ouer the huge *Atlantick Ocean*, which must needs cast forth many watric and moist vapours, which beget raine and showres: from the moisture of which Westerne winde some haue sought out an answer to that Probleme: why hunting hounds should not sent, nor hunt so well, the winde being in the West, as at other times? For, say they, it is caused by the moisture of it; either in making hinderance to their legges in running; or at least to their smell, being very thicke and foggy. In this Westerne wind we may also perceau much cold, which is caused by the qualitie of those watric vapours, through which it passeth, which being drawne from the water, are naturally cold. In our South wind we shall finde both heat and moisture: whereof the former ariseth from the Sunne, which in those Southerne Regions neere the *Æquatour* is most predominant; The latter from the naturall disposition of the place: because before it approacheth our coasts, it passes over the *Mediterranean*

Mediterranean Sea, out of which the Sunne begets abundance of watry vapours, which mix themselves with the winles. Finally the *North-winde* is obserued to be cold and drie. It must of necessity be cold: because it is carried ouer diuerse cold and snowie places, most remote from the heat of the Sunne. It is drie; because it passeth ouer many Ilands and dry places, sending out store of dry exhalations: as also because the Sunne being very remote from those Regions, fewer exhalations are drawne vp, which might infect it by impressions of their watric qualitie. These instances may serue to proue our assertion: That Meteors, wherewith the Aire is vsually charged, and by consequence, their qualities imprest into the Aire, are depending from the Earth, out of which they are drawne, either *Directly* from the same Region which they affect; or *Obliquely*, from some other Region remote from it. How soeuer, wee obserue, that the disposition of the Ayre depends from the Soile, we cannot altogether exclude the Heauens, as shall be taught hereafter in place conuenient.

C H A P. III.

*Of the Adiuncts of a place in respect of
the Heauens.*

1.  E haue in the former Chapter spoken of the Adiuncts of a place in respect of it *Selfe*. Wee are now to proceed to such Accidents as agree to a place, in respect of the *Heauens*.
2. The Adiuncts of the Earth in respect of the Heauens are of two sorts; either *Generall* or *Speciall*.

E

Generall

Generall, I call such as are abstracted from any speciall qualitie, or condition of the Earth, or any place in the Earth. These accidents concerne either the *Situation* of the Inhabitants, or the *Division* of the places: both which we haue handled in our *Sphericall* part of *Geographie*: The *Speciall* are such as concerne the nature of the place in respect of the Heauens, not *Absolutely*, but *Respecting* some speciall qualities or properties depending on such situation; which more properly belongs to this part: For the unfolding of which, before wee descend to particularities, we will premise this one generall Theoreme.

I *Places according to their diuerse situation in regard of the Heauens, are diuersly affected in quality and constitution.*

This Proposition needs no prooffe, as being grounded on ordinary experience: for who findes not betwixt the North and the South, a manifest difference of heat and cold, moisture and drouth, with other qualities thereon depending, as well in the temper of the soyle it selfe, as the naturall disposition of the inhabitants. Only three points will here require an exposition: First, by what *Meanes* and instruments the Heauens may be said to worke on the Earth. Secondly, how farre this operation of the Heauens on the Earth may extend, and what limits it may suffer. Thirdly, how these operations are distinguished one from the other. Concerning the first, we are taught by our ordinary Philosophers, that the Heauens worke on inferiour bodies by three instruments, to wit, *Light*, *Motion*, and *Insuffences*. By *Light*, as by an instrumentall agent, it ingendreth heat in the Aire and Earth; not that the light being in a sort an Immateriall qualitie, can immediatly of it selfe produce heat, being materiall and elementary; But by attrition and rarefaction, whereby the parts of the aire being made thinner, approach neerer to the nature of fire, and so conceaue heat. This is againe performed two waies: either by a simple or compounded beame. The simple Ray is weaker. The compounded inferring a doubling of the Ray by *Reflection*, is stronger and of more

more validitie in the operation : and by consequence so much the more copious in the production of heat, by how much more the reflection is greater : if wee meereely consider it in regard of the Heauens, without any consideration of the quality of the Earth. By motion the heauens may exercise their operation on the Earth two waies. First, by attenuating and rarefying the vpper part of the Aire next adioining, turning it into *Fire* (as some Philosophers would haue it) whence the inferior parts of the aire communicating in this affection must needs partake some degrees of heat; But this I hold to bee a conceit grounded only vpon *Aristotles* authority; who supposed the heauens to be a solid compact body: which will not so soone be granted of many of our moderne Mathematicians. Secondly, the heauenly bodies may be said to worke on inferior things by motion; in that by motion they are diuersly disposed and ordered to diuerse Aspects and configurations of the Starres and Planets, whereby they may produce diuerse effects: so that in this sense the heauens are imagined as a disponent cause, which doth not so much produce the effects themselves as vary the operation. Hereon is grounded all *Astrologie*, as that which out of diuerse aspects and combinations of the Planets and Signes foresheweth diuerse euents. The third Instrument, by which the Heauens are said to worke, is the heauenly influence; which is a hidden and secret qualitie not subiect to sense, but only known and found out by the effects. This third agent being by some questioned, would hardly bee beleued; but that a necessity in nature constraines it. For many effects are found in inferior bodies, caused by the heauens, which can no way be ascribed to the *Light* or *Motion*. As for example, the production of *Metals* in the bowels of the earth, the *Ebbing* and *Flowing* of the Sea; whereof neither the one or the other can challenge any great interest in the *Light*: Forasmuch as the former is farre remote from the Sunne-beames: the other ceaseth not to moue in his channell, when the Sunne and Moone are both vnder the Earth. Besides, who can giue a reason of the excesse of heat in the *Canicular* or Dog-daies, if he exclude this influence? For if wee consider the *Light* of the

Sunne, we shall finde it greater at the time of the *Solstice*; the reflection being greater approaching neerer to right Angles. If we consider the Earth, we shall finde no reason at all, why the heat should be more predominant at this time then another. Then must we of necessity ascribe it to a speciall *Influence* of the *Dog-starre* being in coniunction with the Sunne. Many other Instances might be here produced, but I hold it needlesse, being a matter consented to amongst most Philosophers. The second point concernes the *Extent* and limitation of this operation in inferiour bodies: for unfolding of which point, wee must knowe that this operation may haue respect either to the Elements of *Earth* and *Aire*, or else to the Inhabitants residing on the Earth. For the operation of the Heauens vpon the Elementary masse, experience it selfe will warrant; yet with this limitation, that this operation is measured and squared according to the matter whereinto it is receaued: as for example, we shall finde the *Moone* more operative & predominant in moist Bodies, then in others, partaking lesse of this quality. Likewise the heat caused by the Sunne more feruent where it meets with a subiect which is more capable. Whence it comes to passe that one Country is found hotter then another, although subiect to the same Latitude in respect of the Heauens: for howsoeuer the action of the Heauens be alwaies the same and vniforme in respect of the Heauen it selfe, yet must the same bee measured and limited according to the subiect into which it is impress. For the Inhabitants, wee are to distinguish in them a twofold nature: the one *Materiall* as partaking of the Elements, whereof euery mixt body is compounded. The other spirituall, as that of the Soule. The former wee cannot exempt from the operation of the Heauens: forasmuch as euery Physician can tell how much the humours and parts of our body are stirred by celestiall influence, especially by the *Moone*, according to whose changes our boates daily vndergoe an alteration. For the humane soule, how farre it is gouerned by the stars is a matter of great consequence; yet may wee in some sort cleere the doubt by this one distinction. The Heauens may be said to haue an operation vpon the soule two manner of waies.

First,

First, *Immediately* by it selfe. Secondly, *Mediately* by the humours and corporeall organes, whereof the Soule's operation depends. The first we absolutely deny; for the soule being an immateriall substance, cannot be wrought vpon by a material agent, as Philosophers affirme: for the second, it may be granted without any absurditie: For the operation of the soule depends meerely on materiall and corporeall organes. The Elementary matter, whereof these organes consist, are subiect to the operation of the Heauens, as any other Elementary matter. So that we may affirme the Heauens in some sort to governe mens mindes and dispositions, so farre forth as they depend vpon the bodily instruments. But here we must note by the way, that it is one thing to inferre a *Necessity*; another thing to giue an *Inclination*. The former we cannot absolutely aver; forasmuch as mans will, which is the commandresse of his actions, is absolutely free not subiect to any naturall necessity, or externall coaction. Yet can we not deny a certaine inclination; forasmuch as the soule of a man is too much indulgent vnto the body; by whose motion it is rather perswaded then commanded. The third point we haue in hand, is to shew how many waies the Heauens by their operation can affect & dispose a place on the Earth. Here we must note that the operation of the Heauens in the Earth is twofold; either ordinary or extraordinary. The ordinary is againe twofold; either *variable* or *Invariable*. The variable I call that which is varied according to the season, as when the Sunne by his increase or decrease of heat, produceth *Summer* or *Winter*, *Spring*, or *Autumne*; which operation depends from the motion of the Sunne in his *Eclipticks* line, wherein he comes sometimes neerer vnto vs, sometimes goeth farther from our verticall point. The Invariable, I call that, whereby the same places are supposed to inioy the same temperament of heat or cold without any sensible difference in respect of the Heauens; putting aside other causes and circumstances: for howsoever euey Region is subiect to these foure changes, to wit, *Summer*, *Winter*, *Spring*, and *Autumne*: yet may the same place inioy the same temperament of *Summer* & *Winter* one yeare as it doth another without any great

alteration; and this depends from the situation of any place nearer or farther of in respect of the *Equinoctiall* circle. The *Extraordinary* operation of the Heauens depends from some extraordinary combination or concurse of Planets particularly affecting some speciall place; whence the cause may be probably shewed why some place should some yeares prooue extraordinary fruitfull, other times degenerate againe to barrennesse: or why it should sometimes be molested with too much drouth, and other times with too much moisture. To let passe the other considerations as more appertaining to an *Astrologer* then a *Geographer*, we will here only fasten on the *Invariable* operation of the Heauens on earthly places; and search how farre forth the places of the Earth are varied in their Temper and Quality, according to their diuerse situations, and respect to the *Equinoctiall* circle; taking only notice of the Diurnall and ordinary motion of the Sunne in his course. Herein shall we finde no small varietie, not only in the temper of the Ayre, but also in the disposition and complexion of the Inhabitants: both which we shall more specially declare: the former in this Chapter; the other in due place: wherein we shall haue occasion to treat of the materiall constitution and manners of diuerse Nations.

- 2 In respect of the Heauens, a place may be diuided two waies: First, into the *North & South*. Secondly, into the *East and West*.
- 3 Any place is said to be *Northerne* which lyeth betwixt the *Æquatour* and the *Arcticke Pole*. *Southerne*, betwixt the *Æquatour* and the *Antarcticke-Pole*.

The whole Globe of the Earth (as we haue formerly taught) is diuided by the *Æquatour* into two Hemispheres; whereof the one is called *Northerne*, lying towards the *Northerne* or *Arcticke Pole*; the other towards the other Pole is called the *Southern*

Southerne. But here to cleere all doubt, wee must vnderstand that a place may be said to bee Northerne or Southerne two manner of waies: either *Absolutely* or *Respectively*: Absolutely Northerne and Southerne places are tearmed, when they are situated in the *Northerne* or *Southerne* Hemispheres, as wee haue taught in this Definition; But such as are Respectively Northerne, may be vnderstood of such Regions, whereof the one is situate neerer the Pole, the other neerer the Equatour. In the first place here we are to consider a place as it is absolutely taken to be either North or South: Concerning which wee will particularly note these two Theorems.

I *Northerne and Southerne places alike situate, generally inioy a like disposition.*

We haue formerly granted to euery Region or Country a speciall quality or temper: although lying or situate vnder the same Latitude. But here excluding all concurrent causes which may vary the temper of the Soile, wee consider the disposition of a place so farre forth as it depends on the *Heauenly Influence* or operation. In which sense we cannot deny to a place of like site, a like nature, for as Philosophers vse to speake, *Simile qualesimile semper aptum naturam est simile producere*; Like causes alwaies produce like effects: so the Heauens in like distance, being disposed alike as well in regard of *Light* as *Influence*, cannot but affect those parts of the Earth in the selfe same manner. For the Instruments by which the heauens worke on inferior bodies (as we haue shewed) are *Light* and *Influence*. For both the Light and Influence, it is certaine that in places of equall Latitude and respect to the Equatour, it is cast equally: both the one and the other being imagined to be carried in direct lines or beames, which with the *Horizon* makes like Angles. Now that the validity or weaknes of the operative Raies is to be iudged according to the *Right* or *Oblique* incidencey, making right or oblique Angles, no Mathematician will gaine say. But here we must note by the way, that we only consider the Heauen according to his generall Influence or operation depending chiefly on the Sunne: not of the speciall operation

of speciall Starres, for it may be some particular constellations in the Northerne Hemispheare may bee indowed with some speciall influence, which is not found in the Southerne; or the South in this kinde goe beyond the North. But this kinde of Influence is rare and hard to finde, by reason of the various mixture of diuerse constellations in their operation in the same subiect: and howsoever it were we'l knowne, yet it is not so notable to take place before this common Rule, which wee shall finde to take place, if not exactly, yet commonly through out the whole Terrestriall Spheare. Thus *Bodin* shewes a great likenesse betwixt the higher *Germany*, and the kingdome of the *Pantagones*, in the South part of *America*, out of the great *Stature* of the inhabitants, which must needs proceed out of the nature of the places, which are found to be situate very neere vnder the same *Parallell*. The like correspondency haue we noted betwixt *Guinea* in *Africke* and that part (as it is thought) of the *South Continent*, which they haue for this cause tearmed *Nova Guinea*: many more *Parallells* in this kinde might be found out; but these may suffice in so euident a matter.

2 *The Northerne Hemispheare is the Masculine, the Southerne the Fœminine part of the Earth.*

It hath beene a vsuall kinde of speech amongst men to tearme such things as are stronger, worthier, or greater, *Masculine*: on the contrary side such things *Fœminine* as are found deficient and wanting in these perfections: by which kinde of Metaphor taken from the Sexes in liuing creatures they haue ascribed to the Northerne Hemispheare a Masculine Temper in respect of the Southerne, which comes farre short of it: for howsoever no cause can bee shewed in regard of the Heauens (as is taught in our former Propositions) except by some speciall constellations of the South, which is full of vncertainry, & as soon denied as affirmed; yet comes it to passe by some hidde propertie of the places themselves, or at least some casuall Accident or other, that these two Hemispheares suffer a great and notable

notable disparity. For against the large and fertill Territories of the Northerne Hemisphere containing in it wholly *Europe* and *Asia*, with the greatest part of *America* and *Africa*, we shall finde (besides some few scattered Ilands) only three continents to oppose, to wit, a small part of *Africke*, the greatest part of *America Peruviana*, containing in it *Peru*, *Brasile*, & the Region of the *Pantagones*, and the South continent called *Terra Australis Incognita*, and by some others, the *South-Indies*. For the former lying neere the *Cape of good hope*, if we will credit the relations of our owne Merchants, we shall finde the aire by reason of heat, very distemperate, situate betwixt the Equator and the Tropicke of *Capricorne*: The land very barren, the Inhabitants of a brutish disposition, wanting (as it were) all sense of science or religion: bearing heavy as yet the curse of *Noah*, the first father of that *African Nation*. For *America Peruviana* we shall finde it perhaps more happie in respect of the Soyle, although little better in respect of the Inhabitants. Yet for the plentie of Gold mines, whereof they can chiefly vaunt, we shall finde it farre surmounted by the *East Indies*, or at least paralleled by *America Mexicana*, lying on this side the *Equinoctiall circle*. For other commodities, as *Cattle*, *Fruits*, *Herbage*, *Spices*, *Gummes*, and other medicinable roots, and mineralls, lesse question can be made, as being farre inferiour to *Europe*, *Asia*, *Mexicana* and other Regions included within our Northerne partition. Of the third and greatest, which is the South continent, no coniecture can be well grounded, being in a manner all vndiscovered, except some small quillets on the borders of it: by which, if we may iudge of all the rest, we shall almost giue the same iudgement, as of the other. The want of discovery in this age of ours, wherein Navigation hath bene perfected and cherished, is no small argument to proue it inferiour in commodities to other places: Neither had the slacknesse of the *Spaniard* given that occasion of complaint to *Ferdinand de Qwir*, the late discoverer of some of these parts, had not the *Spanish King* thought such an expedition either altogether fruitlesse, or to little purpose. For who knowes not the *Spaniard* to be a Nation as couetous of riches

as ambitious to pursue forraigne Soueraigntie: as such who will more willingly expose the liues of their own subiects, then loofe the least title ouer other Countries. This may bee a probable argument, that this Continent hath not as yet so well smiled on the ambition of this proud Nation, as some other conquests. For *Politick* and *Martiall* affaires, how farre short it comes of our Northerne Hemispheare, I shall speake in due place, where I shall handle the naturall disposition of diuerse Inhabitants according to their situation. To finde out the true causes of this diuersitie, is very difficult: To seeke a reason in some particular constellation, & Influences in the Heauens, or some speciall disposition of the soyle, is too generall to giue satisfaction, and too vncertaine to inforce credulity. Yet putting these aside, I can only guesse at two reasons, which are accidentally, yet strengthened with good probability. The first & greatest is that bitter curse cast on *Cham* and his posterity by his father *Noah*, which no doubt was seconded by Gods displeasure taking place in his habitation. That all these Nations sprung from *Cham*, I dare not confidently auouch: Yet for the most part, it is probable they were of this Race. For the *Africans* it is out of question, as warranted by the holy Scriptures: and it is not vnlikely that many of those Southerne people fetcht their first originall from them. The second cause may be drawne from the *Industrie* and labour of the Inhabitants in tillage and manuring of the ground, wherein the Southerne Inhabitant hath beene more deficient. For it is certaine out of the holy Scripture that *Noahs* Arke, wherein was the Seminary of mankind, and almost all other liuing creatures, rested in the Northerne part of the world: whence both man and beasts beganne to be propagated toward the South, no farther then necessity enforced: the Regions inhabited growing daily more and more populous, and (as it were) groaning to be deliuered of some of her children. Hence may be inferred two consecutaries. First, that the Northerne Hemispheare was inhabited sooner, and is now therefore more populous then the Southerne. Secondly, that the chiefeft and principall men, which were best seated, rather chose to keepe their ancient habitation, sending
such

such abroad, who could either bee best spared, or had the smallest possessions at home. Yet notwithstanding it cannot be imagined but they retained with them a sufficient company and more then went away. Out of which it must needs be granted, that the *Northerne* halfe of the Earth being best inhabited, should be best manured and cultured; from whence the ground must in time proue more fruitfull and commodious for habitation: for as a fruitfull Country for want of due manuring and tillage doth degenerate and wax barren, so diuerse barren and sterill Countries haue by the industrie of the Inhabitants beene brought to fertilitie, and made capable of many good commodities necessary for mans life. If I were curious to drawe arguments from the nature of the Heauens; I could alledge the *Greatnesse* and *Multitude* of Starres of the greater magnitude in our *Northerne* Hemispheare, wherein the *Southerne* is deficient, as also the longer sojourning of the Sun in our *Northerne* Hemispheare: but these as vncertaine causes I passe ouer. Other reasons may perchance bee found out by those who are inquisitiue into the secrets of nature, to whom I leaue the more exact search of these matters.

- 4 Either Hemispheare consisting of 90 Degrees may be diuided into three parts, each of them containing 30 Degrees.
- 5 Of these parts 30 we allot for Heat, 30 for Cold, and 30 for Temperature: vwhereof the former lyeth tovvards the *Aquatour*, the second tovvards the Pole; the third betvvixt both.

The ancient Cosmographers (as wee haue shewed in our former Treatise) diuided the whole Globe of the Earth into five *Zones*, which they supposed had also proportionally diuided the Temper and disposition of the Earth. In such sort that according to the Degrees of Latitude the Heat and Cold

shou'd increase or diminish. Which rule of theirs had been very certaine, were there no other causes concurrent in the disposition of the Earth and Ayre, but only the Heauens. But since that many other concurrent causes, as we haue shewed, mixe themselves with these celestiall operations, and the experiment of Navigatours haue found out a disproportion in the qualitie, in respect of the Distance, some later writers haue sought out a new partition more consonant to naturall experience. The whole Latitude of the Hemisphære consisting of 90 Degrees from the Equatour to the Pole, they haue diuided into three parts, allowing 30 Degrees toward the Equatour to Heat; 30 Degrees towards the Pole to Cold; and the other 30 Degrees lying betwixt both to Temperature. These 30 Degrees for Imagination sake they haue subdiuided againe, each of them into two parts containing 15 Degrees a peece: more particularly to designe out the special disposition of each Region, lying either Northward or Southward from the Equatour, which is the bound betwixt both Hemisphæres. In the first section of 30 Degrees lying Northward from the Equatour, we comprehend in *Africke*, *Numidia*, *Nigritarum Regio*, *Lybia*, *Guinia*, *Nubia*, *Egypt*, *Ethiopia superior*. In *Asia*, *Arabia*, *India*, *Insule Philippina*. In *America*, *Noua Hispania*, *Hispaniola*, *Cuba*, with other parts of *America Mexicana*. In the other extreame section from 60 Degrees of Latitude to the Pole, we comprehend in *Europe*, *Groenland*, *Island*, *Friesland*, *Norwey*, *Suetland* for the most part, *Nova Zembla*. In *Asia*, a great part of *Scythia Orientalis*. In *America*, *Anian*, *Quivira* with diuerse other parts of the North of *America Mexicana*. In the middle betwixt both, betwixt 30 and 60 Degrees of Latitude we comprehend in *Africa*, *Barbarie*; in *Europe*, all the kingdomes except those North Prouinces before named, and almost all *Asia*, except some places toward the South, as *Arabia*, *India*, and the *Philippina Insule*, formerly placed in the first Section; In like manner may we diuide the Southerne Hemisphære into three Sections: In the first, from the Equatour 30 Degrees we place in *Africke*, *Congo*, *Monomotapa*, *Madagascar*: In the Southerne Tract, *Beach*, & *Nova Guinia*, with many

ny Ilands therevnto adioyning, as many of the *Philippine Insula*, with *Insula Solomonis*. In *America*, *Peru*, *Tisnada*, *Brafilin*, with the most part of that Regiō which they call *America Peruana*. In the other extreame Section from 60 Degrees to the Antartick Pole, is couched the most part of that great land scarce yet discovered, called *Terra Australis Incognita*. In the middle Region betwixt both, from 30 to 60 Degrees, shall we finde placed in *America*; the Region of the *Pantagones*, in the Southerne Continent, *Malitur*, *Iava minor*, with many others. In discovering the qualities of these severall Sections or partitions of the earth, our chiefeft discourse must be addressed to the Northerne Hemispheare, as that is more discovered and knowne amongst old and new writers; by which according to the former Proposition one may parallell the other; concerning which we will inferre these Propositions.

- I. In the first Section of the Hemispheare the first 15 Degrees from the Equatour are found somewhat Temperate; the other 15 about the Tropicks exceeding Hot.

That the Region lying vnder the Equatour is Temperately hot, contrary to the opinion almost of all the Ancients, hath beene in part proued heretofore, as well by reason, as experiment: for that all places by how much the neerer they approach the Equatour, by so much more should be hotter (as some imagine) diuerse instances will contradict. It is reported by *Alvarez* that the *Abyssine Embassadour* arriuing at *Lisbone* in *Portugall*, was there almost choaked with extreame heat. Also *Purquer* the Germane, relates that hee hath felt the weather more hot about *Dantzicke*, and the *Balticke Sea*, then at *Tholouse* in a seruent Summer. The causes which wee haue before touched, are chiefly two. The first is, that the Sun is higher in this orbe in respect of those vnder the Equatour, and moveth more swiftly from them, spending on them only twelue houres, whence so great an impression of heat cannot bee made as in other places: for heat being a materiall quality, must ne-

cessarily require some Latitude of time to be imprest into the ayre, or any other subject. From the Diminution of heat in the Region must the ayre needs receaue into it selfe the contrary qualitie of cold. An argument of cold may bee drawne from the testimony of *Alvarez*; who affirms the waters there in the month of Iune, to be frozen ouer with Ice, the Southwinde blowing. The second cause is by iudicious writers, ascribed to the subtilty and rarity of the Aire vnder the Equinoctiall line, which cannot receaue into it selfe so many degrees of heat as the thick and grosse aire of diuers places distant. For the North Region, wherein *Europe*, and a great part of *Asia* is placed, is for the most part full of waters, which bursting out of secret & vnknowne concavities; doe produce infinite *Fennes*, *Bogges*, *Lakes*, and *Marishes*, which in the Summer season cause infinite vapours to abound, which being intermixed with heat, scorch and heat more feruently then the purer ayre of *Africke*, being for the most part free from the mixture and concourse of such slimie vapours. That the aire being thickned should yeeld a greater seruour, every man out of ordinary experience can frame to himselfe an argument: For wee see Fire and Heat being incorporated (as it were) in the Steele or Iron, to burne and heat more then in Aire or Wood. The like reason some would drawe from the keepers of Stoues or Hot-houses; which doe besprinkle the ground with water, that the vapour being contracted and the aire thickned, they may the longer and better maintaine heat and spare Fuell. Another cause (which we haue formerly touched) may be drawne from the *Set* and *Anniuer*-windes which blowe most part of the yeare one way. *Iosephus Acoffa* obserues that betwixt the Tropicks the winde is for the most part Easterly, beyond Westerly: and a Dutch discoverer hath related that in *Guinea* they haue a certaine winde which comes from the land till noone: and then very violent from the Sea, insomuch as the Inhabitants are wont to traffick in the morning being not able to indure it: which if it bee true we cannot imagine this Region to be so hot as men suppose. For here the heat in the night is aswaged, by the absence or remotenesse of the Sunne: Likewise the excesse of heat incident

to noonetide, is much qualified (or as it should seeme by this relation) altogether vanquished by the cold winde deriued from the Sea. Another reason no lesse probable may be deriued from the excessive height of the land and great mountains, observed to be neere or vnder the line, whose tops are alwayes covered with Snow, may giue a sufficient testimony of cold. For instance, wee need goe no farther then the ridge of the mountaines *Andi* in *America*, where they obserued the Ayre to bee so thinne and cold, that it inforced them to scowre and vomit, which came nere it. The like whereof is related of another called *Panas*, where the extremitie of cold cutteth off their hands: From which experience we may finde some places neere the Line to be more infested with cold then heat. The last and greatest reason may bee taken from the continuall moisture wherewith the regions situate betwixt the Tropicks frequently abound. This moisture is deriued from two causes; 1 from the melting of the Snow on the tops of the mountaines by the Sunne, which running from thence continually into the vallies, keepe them almost alwaies wattrish, especially in the midst of Summer when the Sunne is neereest. 2 From the extreame heat of the Sunne, which being very neere, and many times vertically, raiseth vp continually moist vapours in great quantitie: These vapours in so short a time as 12 houres, being not consumed, but meeting with the cold from the middle Region of the aire, are therewith conuerted into drops, which fall downe againe in great showres: insomuch as some trauelllers of good credit haue told me, that all the while they sayled betwixt the Tropicks, they seldome saw the Sunne, by reason of raine and cloudy vapours. Whence wee note with *Iosephus Acoffa*, by way of consuetary, that the presence of the Sunne betwixt the Tropicks produceth moisture, but contrariwise without the Tropicks, it is the cause of drouth: whence the inhabitants inioy as it were a Winter, when the Sun is to them vertically, because of the distemperature by Windes, Raines, and Stormes, and great Inundations, wherevnto commonly all great riuers betwixt the Tropickes are most subiect. Also they seeme to haue a Summer, when the Sunne is in or neere the Tropicks because

because being somewhat remoued, he cannot be so powerfull in drawing such store of vapours and exhalations which he can dispell and consume. Thus wee see the moiety of this first Section lying 15 degrees from the Equatour, howsoever subiect to a greater reflection of the Sunne-beames, yet through the concurrence of other causes to be found indifferently Temperate, and the other 15 degrees about the Tropicks; howsoever subiect to a lesser Reflection to be excessive hot: which later cause, besides all which hath beene said before, shall bee further confirmed hereafter by the completion of the native Inhabitants, which we shall finde to be *Choller-adust*, the true symptome of an externall heat. But if any man shall answer that this accident is incident as well to the Regions situate vnder the Equatour, as to that vnder the Tropicks; I will produce another reason drawne from the colour of their countenances; which vnder the Equatour is not seene so blacke and swartie as elsewhere. For toward the Tropicke, is placed the Land of *Blackmores*, or *Nigritarum Regio*, where the people are all coleblacke: which might perhaps happen also to those that dwell vnder the other Tropick; but that other causes interpose themselues, which hinder the excesse of heat, which is taken to be the chiefe cause of this blacknes; Here some would oppose the opinion of *Herodotus*, which referred the cause of this blacknesse in the Negroes, to the *Seed* which hee would haue to be black: others would haue this blacknesse as a curse inflicted vpon *Chams* posterity: but these opinions carry very little shew of probability. For first, if this former opinion were admitted, it would of necessitie follow (saith *Bodin*) that *Ethiopians* in *Seychia* should alwaies be borne blacke, and *Seythians* in *Ethiopia* should be alwaies white. Forasmuch as all nations from the beginning of the world haue beene confused and mixt by the distraction of Colonies: but experience teacheth vs, that men transplanted into another Soyle, will in manner of trees and Plants by little and little degenerate & change their first disposition. As if a *Blackmore* marry and beget children here with vs in *England*, experience will plainly declare the children to be more inclining to whitenesse then the fathers
and

and the grand children more then them. Secondly, if the second opinion of *Chams* curse deserved any credit; I see no reason why all his posterity (such as by most writers consent, are generally the people of *Affricke*) should not bee subiect to the same execration, as well as one little parcell of it. Moreover it is reported by *Plinie*, and confirmed by *Appian*, that in those places are many blacke Lions, which wee can ascribe to no other cause then the excesse of heat, and not to any quality of the Seed, or any curse inflicted on the place: Moreover it is reported by *Ferdinando de Quir* in his late discovery of the South Continent, that he there also found some black people; yet can we not imagine this Land, though stretching very farre in quantity toward the Equinoctiall, to come so farre or much farther then the Tropick of *Capricorne*. These arguments make it the more probable that the Regions situate vnder the Tropicks, generally exceed more in heat, then those placed in the middle of the Earth vnder the Line.

- 2 In the other extreame Section from 60 Degrees towards the Pole, the first 15 Degrees towards the Equatour are more moderately cold; the other towards the Pole most immoderately cold, and vnapt for convenient Habitation.

That this Section of 30 Degrees comprehended betwixt the 60 Degree and the Pole, is in a sort habitable, is confirmed by the testimony of many Navigatours, especially the *English* and *Hollanders*; who haue aduentured very farre Northward, and haue there found the Earth, though not so fruitfull, yet furnished with some commodities, and peopled with Inhabitants. The first 15 Degrees towards the Equator admit of no great exception, containing in their extent *Finmarke*, *Bodia* in *Scandia*, *Nova Zembla*, *Anian*, *Groenland*, with many other places indifferently discovered: where they haue indeed found the aire very cold in regard of this of ours: Yet not so Immoderate,

but that; it can at all times agree with the naturall temper of the native Inhabitants, and at least at some times of the yeare admit a passage for forraigne Nations. But the other Region stretching Northward from 75 Degrees to the Pole it selfe, howsoever it may be probably thought habitable, yet affords it no convenient meanes and sustenance for mans life, in respect of other places; neither can the people of this climate inioy any good complection or Temperament of the foure qualities; forasmuch as the cold with them is so predominant, that it choaketh, and almost extinguisheth the naturall heat; whence *Hypocrates* saith that they are dried vp, which is a cause of their swarty colour, and dwarfish stature; which assertion of his can obtain no credit, but of such Northren people as liue neere the Pole; Neverthelesse wee shall not finde these poore Northren nations, so destitute altogether of vitall aides, but that their wants are in some sort recompensed by the benefit of nature. The chiefeest comforts in this kinde, which we inioy, and they seeme to want, are *Heat* and *Light*. The defect of heat is somewhat mollified; 1 By the Sun staying so long about their Horizon as 6 months, and by consequence impressing into the Aire a greater Degree of heat. 2 By the naturall custome of the Inhabitants, neuer acquainted with any other temperature: both which reasons we haue formerly alleaged. 3 By the industrie of the Inhabitants, being taught by necessity to preserve themselves during the Winter time in *Caves*, *Stones*, and such like places heated with continuall fires: the defect of which providence, was thought to be the ruine of *Sr Hugh Willoughby*, intending a search of the North east passage on the North of *Lapland* and *Russia*. To recompense the defect of Light, Nature hath provided two waies: 1 In that the Sunne in his Parallell comming neerer and neerer to the Horizon, giues them a long time of glimmering light both before his rising & after his setting: which may serue them instead of day. 2 For that the Sunne and Starres by reason of a refraction, in a vaporous and foggie Horizon, appeares to them sometime before he is truly risen: w^{ch} caused the *Hollanders* in *Nova Zembla*, to wonder why they should see the Sunne diuerse daies before according

According to their account he was to rise above their Horizon according to Astronomicall grounds: which problem had staggered all the Mathematicians of the world, had not the Perspective Science stepped in to giue an answer.

- 3 In the middle Section betwixt 30 and 60 Degrees of Latitude, the first 15 are Temperately Hot, the other 15 more inclined to Cold.

The middle Region partakes a mixture of both extreames, to wit, of the cold Region towards the Pole, and the hot towards the Equatour: whence it must needs follow, that the more any parts of this Tract approach the hot Regiō vnder the Tropicke and Equatour, the more it must partake of Heat: yet this heat being mitigated by some cold by reason of the fire of the Sun, it must of necessity be Temperate and very apt for humane habitatiō. Also this mixture of the cold quality being more extended and increased on the other moiety towards the Pole through the vicinity of the cold Region, must loose much of the former heat, which shall hereafter be more confirmed out of the naturall constitution & complection of the Inhabitants; bearing the true markes of externall cold and internall Heat: whereof the one is strengthened by the other: For the externall cold, if it be not ouer predominant, and too much for the internall Heat, will by an *Antiperistasis* keepe in & condensate this heat, making it more seruent and vigorous.

- 6 The East & West Hemispheres are bounded and divided by the Meridian passing by the *Canaries* and the *Molucco* Ilands.
- 7 The East Hemisphere reacheth from the *Canaries* the *Moluccoes* on this side; as the other on the opposite part of the Sphere.

We may here note a great difference betwixt this diuision and the former. For the North and South Hemispheres being diuided by the Equatour, are parted (as it were) by Nature it selfe, and the Sunnes motion; But the diuision of the Globe into East and West, we can ascribe to no other cause, then mans Institution: yet are the Easterne and the Westernne found to differ many waies, the discouery of which may giue great light to obseruation.

1 *The Easterne Hemisphere wherein we liue
is every way happier and worthier then the
other Westward:*

How far short the Westernne Hemisphere comes of this of ours, many circumstances may declare. For first, if we compare the Quantitie of Land, we shall finde a great disparitie. For the Westernne Hemisphere containes in it besides the Southerne Continent (wherein ours also claimes a moiety) only *America*, with the Ilands therevnto adioyning: whereas the other within this large circuit containes all the other parts of the Earth knowne vnto the Ancients, as *Europe*, *Asia*, and *Africke*; with many Ilands to them annexed. Moreouer it is probably conjectured by some, that *America* is vsually on our Mapps and Globes, especially the more ancient, painted and delineated out greater then indeed it is: which hath been ascribed to the fraudulent deceit of the *Portugalls* heretofore; who to the end they might reduce the *Molucco* Ilands to the *East Indies*, then their owne possession; sought as well in their Mapps as relations to curtaile *Asia*, and inlarge *America* in such sort, as the *Molucco* Ilands might seeme to fall within the 180 Degrees Eastward, wherein they fed themselves with vnkowne substance, and the *Cassilians* with painted shadowes. But to let passe the quantity as a matter of lesse moment and lesse questioned; a great disparitie will be found in the *Qualitie* and *Dispositions*. For what one commodity almost was euer found in this Continent, which is not only paralleled, but surmounted by this our Hemisphere? If we compare the Mines of Gold & Siluer wherein consists the wealth and riches of both places; our *East Indies*

Indies will easily challenge the superiority. If *Trees, Plants, Herbage, & Graines*, let our Physicians & Apothecaries iudge, who owe most of these medicinable drugges to *India*: Let our Merchants answer, which owe their Spices to *Arabia*, their Wines, to *Spain, Italy, the Mediterranean, Gracian, & Indian* Islands; their Silkes, Linnen, Cloathing, and their furniture almost wholly to *Europe*: If we compare the multitude and various kindes of Beasts bred and nourished in either place, no question but *Europe, Asia, and Africa* can shew farre greater Heardes of *Sheepe, Cattle*, and such like, with farre greater variety of kindes, then euer were found in this new found Continent. If all these fayled, yet the well tempered disposition of the *Europeans* and *Asians* in respect of this barbarous and vnnurtured place, disdaines all comparison: where we shall obserue on the one side a people long since reduced to ciuility, instructed as well in liberall sciences, as handy-crafts, armed with martiall discipline, order'd by Lawes and ciuill gouernment, bound with a conscience and sense of Religion; on the other side a multitude of miserable and wretched nations, as farre distant from vs in ciuility, as place; wanting not only gouernment; Arts, Religion, and such helps, but also the desire, being senselesse of their owne misery.

2 *The difference of East and West cannot work a diuersitie in two places by any diuersity of the Heauens.*

East and West places compared together, are either of æquall or vnæquall Latitude. For places of vnæquall Latitude no question can bee made, but they receaue a greater variety of Temper from the Heauens; as we haue formerly proued: but this disparity growes not out of the diuersity of East & West, but the distance of North and South. But that places alike situate in Latitude, cannot vary by any diuersity of the heauens is plaine: forasmuch as all things to them rise & set alike, without any diuersitie: wherefore, if any such diuersity bee at any place found, we ought not to seeke the cause thereof in the hea-

vens, but rather in the condition of the Earth it selfe, which no question suffers in diverse places of the same Latitude a great variety.

8 Either Hemisphære may againe Respectively be subdivided into the *West* or *East*. The *West* in this our Hemisphære I call that which is neerer the *Canary* Islands; the *East* that which lieth towards the *Molucco* Islands; to which points there are others correspondent in the other Hemisphære.

I *Places situate towards the East in the same Latitude, are hotter then those which are placed towards the West.*

For the explanation of this Theoreme, we are to examine two matters; First, what probability may induce vs to beleue the *East* to bee hotter temper then the *West*. Secondly, what should be the cause of this diuersitie in both places, being supposed equally affected, in respect of the Heavens: for confirmation of the former, many reasons haue beene alleaged of old and late writers. It is agreed on (saith *Bodin*) with a ioint consent of the *Hebrewes*, *Greeks*, and *Latines*, that the *East* is better tempered then the *West*: which hee labours to confirme; First, out of many speeches of *Ezekiell*, *Esay*, & the other Prophets, where the *East* seemes to challenge a dignitie & prerogatiue aboue the *West*; which betokeneth (as he imagines) a blessing of the one aboue the other. But I dare not venter on this Interpretation without a farther warrant. Secondly, we may here produce the testimony of *Pliny* in his seventh booke, where he affirms that by ordinary observation, it is found that the pestilence commonly is carried from the *East* into the *West*, which *Bodin* testifies himselfe to haue found by experience in *Gallia Narbonensis*, and many other historie

seems

seeme to iustifie. *Amianus* a Greeke Author, obserues that *Seleucia* being taken, and a certaine porch of the Temple being opened, wherein were shut certaine secret mysteries of the *Chaldeans*; that a suddaine contagion arose of incurable diseases, which in the time of *Marcus* and *Verus* from the farthermost ends of *Persia*, spread it selfe as farre as the *Rhene* and *France*, and filled all the way with heapes of carkasses. If at any time the contagion be obserued to be carried another way, an vniuersall pestilence is feared: as according to the histories there happened not long after from *Ethiopia* towards the North, which infested the greatest part of the world. A third prooffe may be drawne from the testimony of *Aristotle*, *Hippocrates*, *Galen*, *Ctesias*, and other graue Authors, who affirme that all things are bred better and fairer in *Asia* then in *Europe*; which must needs argue a better temperature: To back which Testimonies, we need goe no farther then moderne obseruation. Every Geographer will tell you how farre infertility *Natalia* in *Asia* surmounts *Spaine*; and *China*, vnder the same Latitude exceeds both: who knowes not how farre *Fex* and *Morocco* on the Westerne Verge of *Africa*, stand inferiour to *Egypt*, a most fruitfull and happy Region? And how farre short both these come of *India*, situate in the same Climate. An argument of greater heat in the Easterne places may be the multitude of Gold and Siluer mines, Spices, & other such like commodities, wherein *Asia* much excels *Europe*: whereas such mettals and commodities as require not so great a measure of heat in their concoctiō, are rather found in *Europe* then in *Asia*; whence there seemes to arise a certaine correspondency of the East with the South, and the West with the North. The greatest reason of all is taken from the Temper and naturall disposition of the Inhabitants, forasmuch as the *European* resembling the Northerne men, shewes all the Symptomes of inward heat strengthened with externall cold. The *Asiaticke* followes the disposition of the Southern man, whose inward heat is exhausted by externall scorching of the Sunne-beames, & therefore partakes more of Choller, adust or melancholy. But this point we shall more fully prosecute in due place. To shew a cause of this variety

variety is very difficult. Those which in wit and learning haue farre exceeded my poore scantling, haue herein rather confes-
sed their owne ignorance, then aduentured their iudgement. It
were enough to satisfie an ingenuous minde, to beleue that
Almighty God was pleased in the first creation of the world
to endow the Easterne part of the Earth with a better temper
of the Soyle, from whence all the rest deriue their originall:
which seemes not improbable, in that he made *Asa* the first re-
siding place of man after the Creation, the second Semi-
nary of mankind after the Deluge, the only place of our *Sal-
uiours Incarnation*. In this matter I beleue no lesse, and can
speake no more, except I should vrge the beating of the great
Atlantick Ocean vpon our Western shoares; which may in
some sort qualifie the excesse of heat incident to the Easterne
tract, which may produce some degrees of Temperature. But
here also we shall perhaps meet with crosse instances, which
will stirre vp more doubt then satisfaction.

C H A P. IV.

Of the manner of Expression and Description of Regions.

I Auing treated of the generall Ad-
iuncts of places, wee are next to
handle the manner of describing
a Region, which proposeth vnto vs two
points, 1 the finding out the *Position* of two
places, one in regard of the other. 2 The
Translation of such places so found out into
the Globe or Charte.

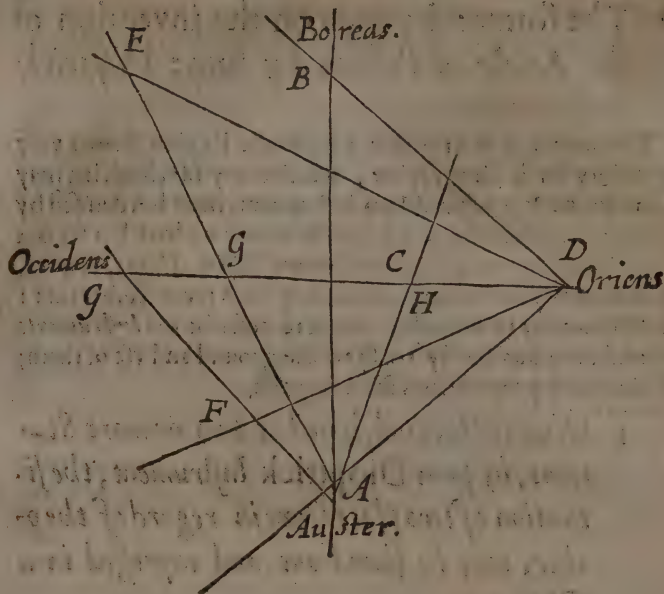
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2 The former depends on the invention of the Angle of *Position* by some *Dioptricke Instrument*.

This maner of descriptiō of a particular Region, seemes very necessary for a Geographer, which euery Mechanician may soon learne & practice. Many instruments haue bin deuised by curious Artificers for this purpose: whose vse hath bin set out largely by later writers, as by *Gemma Frisius*, *Digges*, *Hopton*, and others; to whom my reader may haue recourse, because I hold it not my taske in this subiect to describe the *Instruments* themselues; but briefly to shew the ground and vse of them; which these propositions shall expresse.

1 *Diuerse places obserued at two or more Stations, by some Dioptrick Instrument, the fixation of two places, one in regard of the other, may be found out and expressed in a Plaine.*

This may sensibly be shewed in the Figure following: to expresse which the more plainly, we will set downe these Rules: 1 Let there be drawne in some Chart or plaine plat-forme, a right line, which we must accompt to be our Meridian; because it shall afterward serue for that purpose. This right line shalbe A B, whose two ends A and B shalbe taken for the North and South. 2 You must choose out some high place, as a *Towre* or *Mountain*, from whence you may behold such cities, townes, castles, and other such notable places whereof you desire to know the situation and bearing of the one to the other: This High place is called the *First Station*; where you must place the plaine before prepared in such sort, as it may Astronomically and truly agree with the true Meridian of the place (whose invention we haue taught in the first Booke) and so respect the foure Cardinal coasts, to wit, *East*, *West*, *North*, and *South*; Vpon this place seated in such a man-



ner of situation fasten your *Dioptrick Instrument*, that it may be turned about the point A on euery side at pleasure, in such sort, as the sight may be directed to euery one of the adjacent places. First then remouing it from A, direct your sight to F, and draw the line AF of indefinite length: likewise your Instrument being directed to G, draw the line AG infinitely, which by this meanes will also hit the place E: Let B also be imagined a certaine place, as a City, or Castle, situate in the very Meridian it selfe, which we find already drawne to our hands. In like sort ought we to proceede with the other places C and D, and as many as we please.

This performed, you must remoue your selfe with your *Instrument* and *Plaine* to some one of these places thus fore-marked out; as for example vnto D, which is called the *second station*, and there as in the former, ascending vp some high place, the *Plaine* being first fitted and placed *Astronomically*, take the

the Distance AD of any length whatsoever; for to the greatnesse of this Distance, shall all the rest bee proportionall. Hence so place your *Dioptrick* Instrument at the place D , that it may be turned round, and directed to all those places formerly obserued. In this sort levelling your sight to the place or castle F , draw the line DF : so directing your sight to the rest, you may draw the lines $DCG, DE, DB, \&c$: Now by the points of Intersections of these lines, as in $F, G, E, C, B, \&c$: are to bee described and delineated out the said notable land-markes, as *Cities, Townes, Castles, Promontories*, and such like. Betwixt these places if any man desire to know the distance in miles, he may know it by finding out any one of these Distances; for one being knowne, the rest will also bee exactly knowne: as for example, we will imagine the Distance AD to containe 10 miles: wherefore let the line AD be diuided into 10 equall parts: then with your compasse examine how many such parts are contained in the Distance AF , for so many miles will be likewise in it contained: as for example according to this supposition we shall find it 5 parts: wherefore the castle or city F wilbe 5 miles distant from the city A . He that desires more particularly to acquaint himselfe with the vse and diuerse manners of descriptions of Regions, deriued from this one ground; Let him haue recourse to diuerse Authors who haue particularly laboured in this subject; amongst which our two *Englishmen*, *Digges*, and *Hopton*, deserue not the least praise: whereof the later, out of these principles hath framed a curious Instrument; which he call's his *Topographi-call Glasse*, whose vse he hath perspicuously and exactly taught in diuerse pleasant conclusions, too large for the scope of my methode to insert.

2. *At one Station by opti-call obseruation, the situation of one place in respect of the other, may be found out.*

This may be shewed out of an opti-call experiment, both pleasant & admirable: The ground is expressed in this propo-

sition: The light traicteed by a narrow hole into a darke place, will represent in any Table or white paper within, what soeuer is without directly opposed vnto it: For demonstration of which proposition, we must take as granted of the *perspectiue* Authors, That the visuall Image or species will passe by a right line through any litle hole, & wilbe terminated in any point of the *Medium*: Now that it should more perspicuously be seen in a darke place, then in the light. The cause is assigned to be, because the light of the *Sun* is taken away, or much diminished, which otherwise would hide and shadow the *species* of the thing which is presented to the sight; as we see by experience the greater light of the *Sun* to obscure the *Starres*: which neuer thelesse from the darke boosome of a deepe *Well* or *Mine*, will shew themselves at mid-day. Neuerthelesse we must obserue by the way, that this representation of any thing to the sight by this Image impressed in this sort in a wall or paper, will shew it selfe so, as the parts will be scene inuersed, or (as we may say) turned on the contrary side: as the *higher*, *lower*; the *lower*, *higher*; the *right-side*, to the *left*; and the *left*, to the *right*: which we may declare by an ocular demonstratiō. in this

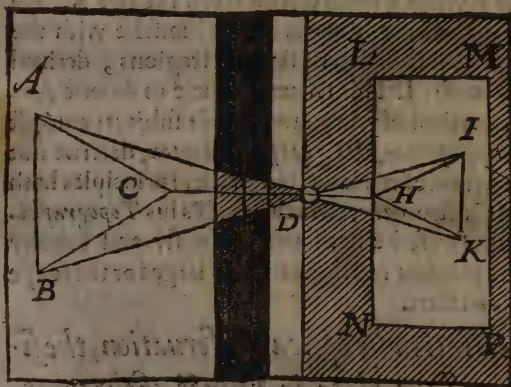


figure heere inserted: Let vs imagine a Triangular platforme of land, whereof we desire to know the situation, to be A B C: from the extreame Angles of this Triangle

we will suppose certaine Rayes to be drawne through the hole D into a darke place, wherein shall be opposed to the hole D, a white Table or paper, which shall be N M: Here will a Ray

1 Ray from the point designing out the Angle at A, be carried through the hole, that it will point out in the Table K. (because all such beames according to the *Opticks* are right lines.) Likewise the Angle B will in the Table designe out the Point I: also C will fall into the point H: Let K H, I K, H I, be ioyned together by right lines, there will appeare the Triangle I K H: wherein the top of the Triangle A will be seene in the lowest place K: Likewise the Angles of the *Basis* B and C, will appeare in the points of the highest place H I: and the right side A C, will shew it selfe in the left H K: as the left side will be the right in I H: wherefore the side of the whole Triangle A B C will shew it selfe in the Table N M, although inversely placed according to the sides and Angles: and of a various greatnesse in respect of the distance of the Table from the hole. This invention hath great vse in *Astronomy*, in observing *Eclipses*, the beginning, end, &c continuance, without any hurt at all to the sight. No lesse vse may it challenge in *Topography* in describing of *Territories*, *Cities*, *Borowes*, *Castles*, and such like, in their due symmetry and proportion: To practise which the better, *Reusner* would haue a litle house built of light Timber, with a *Multangle Basis*: in every one of whose sides, a hole should be made, looking inwardly, at the *vertex*, or top, but outwardly at the *Basis*: through which the species or Image of all such things as are visible may haue free passage:

- 2 The manner of translation of a Region into the chart, depends from the knowledge of the *Longitude* and *Latitude*.
- 3 The parts. to be described, whereof the chart consists, are either *Essentiall*, or *Accidental*: The *Essentiall*, are either the *Lines*, as are the *Meridians* and *Parallels*: or the *Places* to be delineated out by Pictures;

The delineation of both which, shall be taught in these rules.

I *To set downe the Meridians and Parallels in a particular chart.*

To shew the practise hereof, we will take for instance the Region of *France*, an example familiar with our later *Topographers*, and therefore can better warrant the description: *France* is supposed to haue in latitude 10. degrees, in longitude 16: This knowne, you must proceede in this manner: First through the middle of your table from head to foote, let there be drawne a perpendicular line expressing the Meridian of the world, which shall be marked with the letters E F: let this line be divided into 10. equall parts: then draw two *Parallel* lines, whereof the one must crosse the said line about the point E with right angles: and the other *Parallel* must crosse it againe beneath in the point F with like angles: let the vppermost *Parallel* be expressed by A B: The neathermost with C D: Then with your compasse take one of the 10 parts of the line E F, which is one degree, and set that downe apart by it selfe, dividing the same into 60 Minutes, as the short line G H, in the table heere inserted will shew on the right hand. Now you may learne by some Table or Mappe, that the farthest part of *France* toward the *North*, through which is drawne the *Parallel* A B is 52. degrees distant from the *Equatour*: And that the South *Parallel* C D, is distant 42. degrees: Also certaine Tables in our former booke will informe you, that to every degree of the *Parallel* 42. delineated by A B, doe answere 37 miles: and that to euery degree of the *Parallel* C D, answere 45 miles: wherefore with your compasse take from the short line G H, 37 partes or Minutes, and with your compasse kept at the same largenesse, let the *Parallel* A B be divided into 16 equall spaces correspondent to that widenesse (that is to say) on each side of the Meridian 8 parts: at which Meridian E F, you must beginne your measure towards either hand both right and left, marking

marking the end of euery such space with a certaine point: Moreover for the South *Parallell* CD, let 43 parts likewise be taken from the short line GH, and let that *Parallell* be diuided into 16 spaces, correspondent to that widenesse of the compasse, eight spaces being set downe on each side of the *Meridian* EF: So that we must beginne from the *Meridian* EF, and marke the end of euery such space with a point. Then from those points wherewith each of those two *Parallels* AB, and CD is marked; Let there be drawne a right line from point to point, and those shall serue for *Meridians*, expressing as well the longitude of the whole Region, as of euery particular place therein seated. In like sort as you haue diuided the *Meridian* EF, into 10 æquall parts, so againe into the like number of æquall parts must be diuided each of the two vttermost *Meridians*, on the left hand and the right, marking with a point the end of euery such space, and so from point to point let there be drawne right lines, cutting all the *Meridians*, and those shall serue for *Parallels*, and in the vttermost spaces, let there be written the numbers of *Longitude* and *Latitude*. The *Longitude*, is supposed to beginne at the vttermost *Meridian* at the left hand, which in both *Parallels* is the farthest *Meridian* Westward. Now, forasmuch as the most Westerly *Meridian* is fourteene degrees distant from the *Meridian* passing by the *Canary* Ilands, from which as the first *Meridian*, the auncients began their accompts: you must set downe in the first place on the left hand, as well over, as vnder in the first space 15, in the second 16, in the third, 17, &c so orderly proceed through all the spaces, til you come to 30: For the difference betwixt 14 and 30, is 16: So you haue the whole *Longitude* of *France* expressed in your Table, which is 16 degrees: In the like sort to expresse the *Latitude* (hauing the degrees of *Latitude* marked out) you must beginne at each end of the South *Parallell* CD, and so proceed vpward in the two vttermost *Meridians*, writing downe in the first space at the foot of the Table 43 degrees, on the right hand and the left, in the second space 44, in the third 45, and so vpwards along to 52, so haue you expressed the whole *Latitude*

itude of France from North to South: for betwixt 42 and 52 are comprehended iust 10 degrees: These degrees may againe be divided at pleasure into lesser parts, as minutes, according to the largenesse of your chart.

2 To set downe Citties, Castles, Mountaines, Rivers, and such like speciall places in the chart.

The platforme of your chart being once drawne out, as wee haue formerly taught in the precedent rule, you may verily easily set downe speciall places by observation of the Longitudes or Latitudes of such places, either by Instruments or Tables, and reducing them accordingly to your chart: which we suppose before, marked out according to severall degrees: As for example, if we would set downe in our chart the Metropolis of France, which is Paris: having recourse to my Table, I find it to haue in *Longitude* 23 degrees, in *Latitude* 48 degrees. Heere to find out the said *Longitude*, you must extend a threed from the 23 degrees of the *Parallel* A B to the like degree in the *Parallel* C D: then holding it fast, you must crosse that threed with another extended from the *Meridian* A C, to the *Meridian* A D in the points of 28 degrees: The point wherein these two threeds shall cut and crosse one the other, you may take from the true place of Paris, and marke it out in your chart: In like sort you may proceede with all other places. But if you were to describe a river in your chart, it will not be sufficient to take the *Longitude* and *Latitude* of the beginning or fountaine, but of the end, middle, turnings, and angles, Townes, or Cities, by which it passeth, Bridges and other occurrent circumstances: In like sort may you set downe Woods, Forrests, Mountaines, Lakes, and other places whatsoever.

4 Thus much for the *Essentiall* part of the particular Chart: The *Accidental* part wee call the *Scale of Miles*, which teacheth how many

many miles are contained betwixt any two places in the Chart wherein wee are to know two things, 1 The *Fabricke*; 2 The *Use*.

1 The *Fabricke* of the Scale depends from the certaine knowledge of the Distance of any two places in the Chart.


The practise is very easie, and taught in these three Rules:
1 You must search out the distance betwixt any two places whatsoever, which are contained in the Region, described in your Chart; which you may doe either experimentally by your owne knowledge, or some certaine relation of Trauailers. 2 Then must you draw three *Parallel* lines, containing two spaces, one larger, the other lesser, in some voide space of your Chart. 3 You must diuide the said Scale into so many Miles, as the said voide space will giue you leaue, according to the knowne distance first found out: As for example, the distance betwixt *Paris* and *Roane* is knowne to be 30 *French leagues*, which contains 60 of our Miles, allowing for euery such league, 2 Miles. Wherefore your *Parallel* lines being first drawne (as you see in the following Chart) diuide your Scale into 30 parts accordingly, and in the larger space, place your Numbers, as 10. 20. 30. and so forth, so farre as your space will conveniently extend.

2 The Distance of any two places set downe in the Chart, being taken and applyed to the scale, will shew how many miles it containes.

As for example, I would willingly know how many *English* Miles are contained betwixt *Paris* and *Orleans* in my Chart of *France*: Heere I take with my compasse the distance betwixt the said Cities in the Chart, and applying that to the Scale, I find it to containe 50 miles: which is the true measure.

CHAP. V.

Of Hydrography.

1. itherto haue we treated of the Generall Adjuncts, & Proprieties of places in the Terrestriall Spheare: wee are in the next place to handle the Distinction.
2. A place is generally distinguished into *Water* and *Land*: The Description of the former is termed *Hydrography*; The other for distinction we call *Pedography*.
3. *Hydrography* is a Description of the *Water*, with the Accidents therunto belonging.

The *Water* we consider not here meereley *Physically*, as it is an Element, whereof mixt bodies are compounded; but *Topographically*, as it beares a part in the Terrestriall Globe: yet are we not so curious to exclude such *Physicall* problemes & considerations as are most subiect to sense; which a *Topographer* cannot well neglect: being the *markes* and characters, designing out speciall places: To finde out the originall of the *Water*, we must first take as granted, that Almighty God (as we reade in the first of *Genesis*) in the beginning made a separation betwixt the waters *aboue* the Firmament, and the waters *under* the Firmament; whereof the former is termed in the Scriptures *קִינִיּוֹן*, which is as much to say as *expansum*, a thing stretched out, or extended. By these waters *aboue* the Firmament, whether we ought to vnderstand the *cloudie vapours*.

pours in the middle Region of the Aire: or the *pure* fluid and liquid body, whereof the Firmament consists; I leave it to learned divines and critick expositours to dispute: although the propriety of the phrase (if it be well rendered) will seeme to favour this opinion rather then the other: forasmuch as the *Aire* can no way be said to be about the Firmament, except the *Hebrew* terme miscarry in the Translation. For the solidity of the Cælestiall Orbes, which *Aristotle* labours to confirm, is found long since to thwart the observations of *Astronomers*: although it may thus be retained as usefull *suppositions* to settle Imagination. But to let this passe, and come to the waters under the Firmament, understood by the word *Tann*, which signifies as much as a collection of waters: we shall find them to have taken their originall from the separation of the waters substance from the Dry land, caused by God in the first Creation, testified by *Moses* in 1 *Gen*: which once granted (as no Christian can deny) easily rebates the edge of the opinion of some auncient Philosophers, who contended, out of the nature of *Drouth* and *Moisture*, to deriue the beginning of this separation. The drynesse of the Earth (say they) working by little and little, diminisheth or at least resisteth the waters, so that they should not altogether overwhelm the Land: But this reason is altogether deficient in Nature: Because *Drouth* and *Moisture* are no such qualities to have such an operation; and if any such there were betwixt *Drouth* and *Moisture*, the *Drouth* (as we see by experience) would rather draw moisture vnto it, then any way expell it, or drue it away: whence it is most euident, that it was effected by no other meanes then the immediate worke and providence of God, for the preservation of liuing creatures: for, before God said; *Let the waters be gathered into one place*: the Water was said to couer the whole face of the Earth: but afterwards at God's appointment, the water went back, and shewed the dry land. But by what meanes God separated the one from the other, it is much controverted amongst *Divines* and *Philosophers*. Many were of opinion, that the Earth was suffered to stand intire without alteration, and that the waters

were eleuated about it; so that if they were suffered to flow abroad, they might againe couer the face of the Earth, as in the beginning. But why the Waters should be thus restrained, is not agreed among them: for some thought, that this was done by the miraculous power of God, which restraines the flowing abroad of the Water, beyond his ordinary bounds; of which opinion is *St. Ierome*, who grounded his opinion (as it seemes) on the authority of the Scripture, especially in the 8 of the *Proverbs*, and the 103 *Psalme*; where God is said to haue set a bound vpon the seas, which they should not passe: But this reason seemes not warrantable; That the great Creator of all things, should in the first institution of Nature impose a perpetuall violence vpon Nature. Moreover all miracles are temporary, and not perpetuall; for then were it ordinary, and so scarce a miracle: others vpon lesse ground, haue imagined that there are certaine *Northerne* starres in *Vrsus maior* and *Draco*; of so great vertue, that they can draw the Ocean from this habitable part of the earth toward the North, and so constrain the waters, that they cannot overwhelm the earth; but this opinion is ridiculous, and deserves no solide refutation: being a mere conceit, without ground or probability: others vpon the like reason, haue dreamed that there is more water then Earth in the Globe; and that the water by his extraordinary masse occupying the center of the world, turnes the earth on one side, making it to swimme as a ship vpon the sea: But this assertion we haue refuted in our first Chapter of the first booke. All these Authors suppose that the earth is vncouered toward the North-Pole; but overflowed with waters towards the South: which the experience of Nauigatours at this day hath sufficiently disannulled. Others againe, assenting out of a *Peripateticall* dream, that the water is ten times greater then the earth, suppose the earth to be like a sponge to drinke vp the water: to proue which assertion they produce an experiment, that the earth being digged any thing deepe in most places, there will appeare water: whence they collect that the water is mixt with

with the whole earth, and received into it's concavities: But howsoever we may graunt, that there are many and vast concavities in the Earth, capable of Waters; yet it is impossible, that the Water should be ten times as great as the Earth: for by this reason, although all the Terrestrial Globe were Water, it could not be, but that a greater portion of Water, than that in the Earth, should arise above the Earth: because, according to their own *Supposition*, 9 partes should be above the Earth: Neither can *Aristotles* words be well wrested to this interpretation: For as much as he understood this ten-fold proportion of the Water in the Earth, not of the *space*, which they replenished, measured by their *Circles* and *Diameters*: but of the proportion they beare one to the other in their transmutation: as that one measure of Earth turned into Water, should be as much as 10. All these opinions seeming so absurd, it seemeth more probable to imagine, that either the Waters are *condensated*, and thickned, which were in the beginning created thinn: whence will follow, that they should occupy a lesse place, and by consequence, leave the dry land in many places habitable: or, which is more probable; that God in the first Creation made certaine hollow concavities and channels in the Earth, which was before plaine and uniforme: into which the waters were received and bounded, in so much, that they could not flow abroad. This seemes enough to satisfie the search of such as are not too curious to search into his secrets, whose power and omnipotence transcends the capacity of the wisest: In this division of a place into *Water*, and *Land*, we will first treat of the sea, and the accidents belonging thereunto: Not that the water is worthier or greater then the Earth: The contrary whereof we haue proved heretofore: but because the consideration of it, is more simple, as that wherein fewer matters are to be handled then in the land. For Rivers and Lakes, although consisting of this watery element, we thought fit to handle apart: as adjuncts belonging to the land.

4 In the sea are considered two things. 1 The

Adiuncts, 2 The *Diuision*. The Accidents of the sea whereof we are to treat, are either Internall, or Externall.

5 The Internall, are such as are inbred in the sea. These againe are either *Absolute* or *Relative*.

6 The Absolute, are such as agree to the sea, without any comparison with the land: such are either, *Figure*, *Quality*, or *Motion*.

7 The figure is the conformity of the externall superficies of the Sea; whereof obserue this Theoreme.

1 Although the whole body of the water be Sphaericall, yet it is probable that the parts of it, incline to a Conicall figure.

That the whole Water according to it's outward Superficies, is sphaericall and round, is sufficiently demonstrated before, in the first booke. But notwithstanding this roundnesse of the whole, the parts of it may (for ought I see) admit of a Conicall figure; forasmuch as this hath little or no proportion to the vast Sphericity of the Water, no more then little hills, to the greatnesse of the Earth. For the prosecution of which point, I will first shew the reason of this my coniecture, grounded on experience; and afterwards out of the ground and demonstration of the principles of Mathematicall Philosophie, endeavour to make it more manifest. First therefore by a conicall line, we vnderstand a crooked line which differs from a Periphery or circle, in as much as it keeps not alwaies an equall distance, from the center: but is higher in the midst, then on either side. Now if the parts of the water standing still, were

in their higher superficies exactly sphericall; they should by the same grounds be *concentricall*, or haue the same center with the whole Earth: But that it hath not the same center, will appeare by little *dropps* of Water falling on the ground; which incline (as we see) to a round figure; yet were it more then ridiculous to say, that this round convexity of a droppe could be *concentricall* with the whole Earth: sith in so great a masse, it is hardly sensible. But heere our ordinary Philosophers are ready to answer, that this conformity of the water dropps in a round figure, is rather *Violent*, then *Naturall*: because the Water being by nature moist, is ready to fly, and avoid the touch or drouth, or any dry thing. And because the Water thus avoiding the drouth, cannot of necessity but some way touch it, it is imagined to conforme it selfe to that figure, wherein it may least of all touch: This is the round or *sphericall* figure; wherein any body contained, cannot touch a *plaine*, otherwise then in one only point. But against this conclusion of *moisture* flying *drouth*, strong enough is the experiment of *Scatiger*, in his 105 *exercitation*: that *quick siluer* a moist substance, being cast either into Water or Iron Ore, will gather it selfe to a round body; notwithstanding it is manifest, that *quick siluer* naturally neither avoides the touch of Water or Iron, forasmuch as the one is very moist, the other of great affinity, (as our *Chimicks* teach) with *quick siluer*, the parent of all Mettals. Moreouer it is manifest, that this conformity to roundnesse, is in dropps of raine falling to the Earth, through the *Aire*: yet will not our *Peripateticks* admit of any drouth in the *Aire*, which this moist element should seeke to avoid. Moreouer if Water should conforme it selfe to roundnesse, by reason of the drouth of the body, whereon it falls; then must it follow; that either the moisture of the *Water* should expell the drouth of the *Earth*; or else that the drouth of the *Earth* should worke on the moisture of the *Water*; But neither can be graunted with probability. First because moisture & drouth are not qualities of such activity to drive and remoue, one the other from one place to another, as it is here imagined: 2^{ly} if the moist should worke on the dry,

dry, it should either touch it or not: If it touches not, it cannot worke on it; because no *Physicall* action can be performed without touching; besides, it were very impossible, to imagine that without this touch, one of these qualities should perceiue or sent the other to avoid it. If it touch, it auoides not the touch; but ioynes it selfe with the drouth: And indeed reason and experience shewes, that drouth rather couers & drawes vnto it selfe moisture, then expels it; wherefore *Scaliger* goes about to forge a new cause of this experience. Euery thing (saith he) in his nature is one, and the selfe same: But this v-nity in Homogeneall bodies, is best preserved in a *Globe* or *round* figure: wherein is no inequality, no parts higher or lower, abounding or deficient. But heere might a man aske why the greater parts of the Water are not likewise conformed vnto roundnesse, as well as the lesser droppe; He would perhaps answere, that nature in them was not in such distresse, to make vse of this speciall priuledge; I graunt it; yst find I in this no satisfaction; for asmuch as he giues a final cause, where I sought an efficient: for I would farther aske by what action or motion this water should gather it selfe into a circular figure, and from what forme it should arise: for first we haue shewed, that this motion cannot proceed from the externall drouth, we must seeke the cause in the water it selfe: heere we shall finde it, either the *particular* forme of the water, or a certain *vniversal* forme, as some suppose. It cannot be imagined, that it should proceed from the generall forme of the vniverse: First, because as we haue elsewhere proued, there is no such Internall forme of the world: Secondly, those motions are commonly ascribed to an *vniversal* Nature or forme, wherein any particular body (as it were) neglects his owne Nature, for the preservation of the whole Vniuerse. But here water containing it selfe in an orbe, and not flowing abroad towards the Center, rather seemes to forsake the Center and Vniuerse to preserve it selfe. Whence we must necessarily conclude, that this roundnes in drops of water cast on the sand, proceedes not from externall drouth, nor any *vniversal* forme, but from the specificall and essentiall forme of

the water; and consequently, because it makes a circle *excentricall* with the Earth, it must be found rising higher in the midst: To which we will adde another experiment: Let there be cast on a large Table or planke, a litle portion or drop of water: I here aske, whether this water on the midst of the Table & equilibrated, will continually flow abroad, or at length suffer a stay or stop? It cannot be continually spread abroad: first, because experience teacheth the contrary; for we see litle drops cast on such a plaine, to confine themselves within certaine bounds: and least any should imagine (as before) that this happens by reason of the drouth of the Table, let him first moisten the Table, and he shall find no great alteration: Secondly, if the water should alwaies fall downward, and so still run abroad, and spread it selfe to the margents of the Table, it would follow, that if the Table were of an infinite capacity, the water thus shed, would infinitely flow abroad, without intermission; and so should Nature set no bound to the thicknes and motion of the water: whereof experience hath sufficiently taught the contrary. Now, that water thus standing still on a plaine & equilibrated Table, should haue a *Conicall* figure, it may be plainly proued almost by sense, whereby we perceiue the middle to be higher then the extreames: for no man can deny but the water thus standing, is endowed with thicknes, so far as much as it is a naturall body. Wherefore of necessity it must swell about the Table. It cannot be *Spherically Concentricall* with the whole Earth, because in so small a segment of an Arch, as this litle quantity of water admits, it would be insensible. It cannot be plaine, because the sides or extremities of it touch the Table, whereas the middle *superficies*, by reason of the thicknes, is eleuated about the Table. Neither can we imagine another figure besides, which can aptly be admitted: It is meet in the next place, that out of the grounds of Philosophie, we explaine how it comes to participate this figure: where we are first to vnderstand, that the figure of the water is (as it were) compounded of two sphaeres; whereof the first is imagined to be *concentricall* with the whole Earth; the other lesser onely answering to the portion

or quantity of water, were it made round; for if we consider the simple and particular nature of the water, we shall find it inclining to roundnes of it selfe, as we haue shewed by experiment; yet such a sensible roundnes, as cannot haue one *Center* with the Earth. But if we consider the water as it concurreth to the constitution of the whole Vniuerse, we shall find this Figure to partake of a circular segment concentrick with the whole Earth. Now because neither of these two Figures can precisely and exactly arise by it selfe, sith the one must needs somewhat alter the other, we must of necessity admit of a figure mixt and compounded of both these; which can be no other then a *Conc.* To expresse this more plainly (because this path is yet vntroden) we find in the water a double motion directed to this double figuration. The first whereof is that, whereby all the parts of a quantity of water, are inclined to an Absolute roundnes, or Sphericall Figure, without respect of the Vniuerse: the Center of which roundnes, is to be sought in the water it selfe. The later is that, whereby, the parts of the Water conforming themselues to the Center of the Earth, as neare as they can, make a *Sphericall* figure (as much as Nature can suffer) concentrick with the whole Terrestriall Globe. In the former of these motions, the Water seekes it's owne preservation; in the later, the safety of the whole Vniuerse: for the safety and consistency of the whole, is deriued from the parts which concur to preserve the whole. To expresse a litle better the maner of these two cōcurrent operations; we will take for an vndoubted ground, *That God hath giuen to Nature a power and inclination to preserve herselfe.* This granted, we must distinguish of a two-fold preteruation: the one *Speciall*, wherein euery Body seekes it's owne safety: the other *Generall*, wherein all Bodies concur to the preservation of the whole. The former proceedes from the speciall Forme and Nature of euery Body; which is performed by the vnion of all his parts to it selfe; this vnion is greatest of all in a Sphericall figure, wherein all the extreme parts are aequally distant from the Center, admitting no Equality of dimension. The Generall depends from the Resultancy and

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Harmony of all the parts, whereby is caused an vnion of all the parts with the whole; to whose preservation they are secondarily directed: whence ariseth a double figurature of the water; the one of a Spheare, excentricall with the Earth: the other also of a Spheare, but concentrick with the Earth; whereof this Conicall figure is compounded. Why this figure should be more sensible in a small drop or quantity, then in the Ocean, may be declared from the same ground well vnderstood; because the convexity of the lesser Spheare excentrick with the Earth, is more; and of the greater, is lesse: for by how much lesser is the Spheare, the greater wilbe the convexity: and by how much greater the Spheare, the lesser wilbe the convexity, or crookednes. Wherefore this crookednes being in a small measure of water very sensible, in a maine Ocean will by sense be hardly distinguished from a right line.

8 Of the Figure of the Water vve haue spoken: We must nowv speake of the Quality, vvhich is tvvo-fold: Saltnes, & Thickness.

1 *The Water of the Sea is salt, not by Nature, but by Accident.*

That the Sea is of a saltish Quality, no man hath euer doubted, at least in most parts: But whether this saltish Quality, essentially agrees to the center of the Sea, as therein created, or else Accidentally brought in, I find no small difference among Philosophers. Those which defend the saltishnes to be Accidentall, are diuided into diuers sorts: for some of the old Philosophers imagined, that the Earth chafed and Heat with the Sun, continually sweats out water: whence is made the Sea, & therefore should haue a saltish taste, because all sweat is of this Quality: But this opinion I take to be no other then a pleasant Allegory of the old Greeke writers, who wrote their Philosophy in verse, & therefore vsed such allusions; as we shall perhaps find in many other matters, poëticall deuised

of them; yet refuted of *Aristotle* in good earnest: others haue more probably conjectur'd, that this saltishnes was first deriued from the Earth, through whose parts the Water being strained, is apt to receiue this Quality, being primarily in the Earth it selfe: as we see water being wrung through ashes, to grow salt: but this opinion seemeth of no great soundnes; because the first Riuer and Lakes being drawne out of the Earth altogether, and in regard of their small quantiry, more apt to yeeld and receiue this tincture, are notwithstanding deuoid of all such Quality. Besides this, we rather find the contrary by experiment: That Sea Water strained through clay, will turne fresh: as likewise powdred flesh being layed to soake in salt water, will soone turne sweet: The former is verified by *Baptista Porta*: of the other, euery kitchin maide on the Sea side will informe vs. The third opinion is of *Aristotle*, who referres the saltish quality of the sea water to the *Sunne*, as the chiefe cause, drawing and lifting vp out of the Sea store of exhalations, which afterwards mixt with vapours, fall down againe by drops: for the *Sunne* drawes vp the thinner and fresher parts of the water, leauing the thicker and lower water to suffer adustion of the Sunne-beames, and so consequently to become salt: so that the matter of this saltishnes in the Sea, is an exhalation: the Sun drawing vp to the middle Region of the Aire, the fresher parts; where thickned, they descend in raine, leauing the residue of the Sea salt. The forme is the straining and concoction, which is made by the Sun; for the saltishnes is said to arise out of the commixtion of Terrestrial drynesse, concurring with moisture, join'd with adustion of Heat: so that two things, are chiefly concurring to the Generation of saltishnes; to wit, Drouth and Adustion. This seemes to be prooued by instance of Fresh-waters in the kitchin, which turne salt, being much boyled, because the thinner and sweeter vapours of it are drawne vp, & dissipated, leauing that behind which is thicker & saltish. The same would some haue in the Sea, seethed (as it were) & burnt with the Heate, which we experimētally find in hot water on the fire. But this is excepted against by some, because we find by experience,

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that many salt wells and fountaines arise in diuers places of the Earth, which are ingrendred in the bowels of the Earth farre remote and separate from this extreame heate and adustion of the Sunne-beames: But to this we may easily answer, that such salt springs are either by some violence enforced from the sea by certaine secret cavernes, and hollow places of the Earth: or else that they receiue their tincture of saltnesse from some salt minerals of the Earth, through which they passe. Wherefore this opinion of *Aristotle* I see not yet sufficiently refused. The other opinion concerning this quality of such, which would haue it essentiall to the sea water, and inbred in the first creation, is grounded on two finall causes: First they say that the sea is salt, for the preservation of the Fishes, who would otherwise rot, because experience shewes, that Fish will soone putrifie without salt; but this is thwarted by three reasons: First, because if fish were in this sort salted in the sea Water, the cooke might saue himselfe a labour in salting them againe in his kitchen: Also Fishes caught in the sea, are oftentimes preserued longer and sweeter, lesse needing salt then those which are found in fresh Ponds and Riuers: Secondly, if this reason should hold current, why should not the Fishes also rot and putrify in fresh Water? Thirdly, why should fishes couet the fresh Water (as we see by experience in many fishes) if in it they should suffer putrefaction, which is a great enemy to nature? Aboue all what need we feare this putrefaction of fishes, while they are endowed with a living soule, which is a greater preservative then all the salt in the world; or why should we not doubt the same calamity in all liuing creatures in the land, which are as subiect to rottennesse in the Aire, as the other on the land? The second cause (say they) Why the sea should be created salt, is; Because the sea it selfe should not putrify, for asmuch as we find by experience, that salt is the only thing to resist Putrefaction; But heere we may demaund; why these Authots should feare Putrefaction in the vast body of the sea, rather then in other Waters and Rivers, which are neither salt, nor come neere the greatnesse of the Ocean;

whereas *Aristotle* affirms in the fift chapter of the 4 booke of his *Meteors*, that if the sea were divided into many parts, it would more easily dissolue and putrify. The grounds of this opinion being overthrowne, there want not reasons to contradict: First (sayes one) if the sea were not created salt, then was there some time wherein it was fresh: To this I answered two waies: First, that it might be created fresh, yet being apt from the heat of the Sunne to receiue saltnesse, it might, almost at the first receiue it. Secondly, if I should graunt that it was a long time before it embraced this quality, I knowe neither Historie to confute me, or reason to convince me. Secondly, it is vrged from the Nature of living creatures in the sea, that they cannot well liue in fresh waters, and therefore it seemes originally salt, and not by Accident: But this is of no great force: First, because experience shewes, that many kind of fishes liue in both, and many rather cover and desire the fresh Water, then the sea: Secondly, it is not improbable, that as the sea by litle and litle and by degrees turned from freshnesse to saltnesse, the temper and disposition of the fishes, was in like manner changed and altered: Whence it may come to passe, that fishes since bred and nourished in fresh Waters, cannot so well endure the salt. Moreouer who knowes whether all these severall kind of fishes now found in the sea, were from the beginning, since we see by experience, that sundry kinds of living creatures daily arise out of putrefaction on the land, which may with like probability, or more, be admitted in the sea. There are yet behind other reasons of one *Patricius* a *Platonist*, who would oppose *Aristotle* in good earnest. *Aristotle* (saith he) speaking of the saltnes of the sea Water, shewed not the cause. For I would aske, why that parcell of water, from whence the thinner parts are extracted, should remaine salt; was it so from the beginning, or afterwards imprest; was it *Inbred*, or *Accidental*? If he would haue it an inbred quality from the beginning, he vainly goes about to seeke out the cause; If the saltnesse be *adventitious*, the cause is to be giuen; but the cause giuen by him, is not true, for asmuch as it rather takes away the saltnes: But to these

these objections of *Patritius*, spunne out in many words, we may answer two waies: either that the saltnes is meere adventitious bred by an exhalation, drawne vp by the Sunne, and so distilling downe againe; or else, because this answer seemes not wholly to satisfy. (For asmuch as rainy Water is seldome salt, and if it were, could hardly flow in so great quantity to feed the saltnes of the sea): I will answer secondly, that the saltnesse is radically or originally in the matter of the Water; yet so, as it cannot be drawne out and sensibly be perceived in the mixture of many sweet humours, ioyned with it, without a separation first made by the heat of the Sun of the thinner parts from the thicker: So that the Sunne is a disponent, though not a productive cause of this saltnesse in the sea.

2 Seas absolutely salt, are neuer frozen.

This may seeme a *Paradoxe* to some men, in regard that amongst our *Geographers*, we haue so often mention made of *Mare Congelatum*, taking it's name from the Ice wherewith it is shut vp from passage: as also for that in the voyages of *Frobisher*, *Davis*, *Hudson*, and other later Navigatours, which haue bin imployed in the search of the *Northwest* passage, we find such strange relations, not onely of Seas closed vp with Ice, and hindring their passage towards the North; but also of *Rocks* and *Ilands* of Ice, of an incredible greatnes. The truth of these Relations I no way disapprove, but rather out of these testimonies, approve our former assertion; that Seas which are wholly *Salt*, are neuer found to freeze: For first whereas it is called *Mare Congelatum*, it may beare the name well enough from the multitude of Ice floating on the water, or collected into a Rock or Iland. This Ice (as it will easily appeare) is not produced out of the substance of the Salt water of the maine Ocean, but rather carried into the Sea by great rivers of fresh water running into the Ocean: For the rivers are not alwaies frozen; but sometimes by a remission of the cold are thawed, and the peeces broken asunder, and floating into the Sea, in it oft times meet in great heapes, which may be proued: 1. In that these great rocks of Ice melting with the

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heate of the Sun, haue dissolued into fountaines of fresh water, gushing downe in great abundance, wherewith sometimes in case of necessity, they haue fraughted their shippes, as we haue testified by the fore-named Nauigatours. 2^d Because some part of the maine Sea, situate perhaps more Northerne, and in a colder Climate, suffers not this accident: whereas places neare the shore, farther South, are almost alwaies frozen: The reason whereof, is; because the Sea neare the shore is commonly mixed with fresh waters, conveyed in, either by great Riuers, or infinite secret passages vnder ground, which we see not: The reason why that salt waters exclude this propriety incident to the fresh, I take to be the *Hot spirits*, hid in the salt humor, which are more seruent and operative, then those of the fresh water.

9 Somuch for the *saltnesse*: The next, is the *Thicknesse*: whercof we will set downe this *short Theoreme*.

I *The Water of the Sea is thicker then other Water.*


This Proposition hath it's light from the former: because thicknesse of Water is a companion of the saltnesse, as depending from the same cause, to wit, the exhalation, and extraction of the thinner parts of the Water. There are many finall causes giuen by *Patricius* of this thicknes of the Sea Water. First, because the parts of it should more strongly hold together, and not couer and overflow the firme land: But this seemes to be grounded on an error, that the Water should be about the Land; and that it should containe it selfe within it's own bounds and limits, which opinion we haue elsewhere reiected. The second cause of the thicknes of the Sea, is; that it might be more apt to beare and carry shippes, and other great weights for the vse of man. Thirdly, the Water being thicke, may more easily be converted into *salt*, out of which, many saltish minerals in the Earth are ingendred. Other causes are giuen

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giuen by this Author, but lesse forceable, which we will omit, as referring them to the Philosopher, whose proper taske it is to seeke them out.

CHAP. VI.

Of the Motions of the Sea.

- 1  He Motion of the Sea, whereof we are in this Chapter to treat, is either *Naturall*, or *Violent*. The Naturall I call that, which is partly incident to the Naturall Disposition of the Sea.
- 2 This againe is two-fold, either *Generall*, or *Speciall*. Generall is that which agrees generally to all, or at least to most parts of the Sea: such as is the *Ebbing* and *Flowing* of the Sea.

We must here obserue, that the Water hath a two-fold Motion; The first is common to all heavy Bodies, as well as the Earth, in which is an inclination to come as neare as they can to the Center of the Earth, whereof we haue spoken in our former booke: The second is that which more properly agrees to the Sea, which is againe two-fold: either the *Naturall*, or the *Violent*. The Naturall, howsoeuer requiring perhaps the concurrence of some externall cause, is notwithstanding so called; forasmuch as it chiefly seemes to proceede from the Disposition of the Sea-water; The Violent is caused meerely by the violence of the windes mouing the Ocean. The

Naturall motion we haue again diuided into Generall, or Speciall; because the *Afflux*, & *Reflux* of the Sea, whereof we are to treat, is generall throughout the whole Ocean, (some petty creekes perchance excepted) whereas the Currents, (which is the second kind of motion) are more speciall, as agreeing not to a l, or most parts (as it seemes) but to some one or other speciall place, as we shall shew.

1 *The Sea twice every day ebbes and flowes.*

The flowing and ebbing of the Sea, howsoeuer it cannot be precisely obserued in all Seas; yet because few places of the maine Ocean are exempted from it, deserues the first & chiefest consideration. That such a motion there is, experience shewes; but the searching out of the cause, is, for ought I can obserue, one of the greatest difficulties in all *Naturall Philosophie*: insomuch as *Aristotle* one of the acurest Philosophers, is reported to haue stood amazed at the flowing and ebbing of *Euripus*, and despairing of finding out the cause, at length enforced to cast himselfe into the Riuer which had be'ore confounded him. Wherefore it may seeme sufficient for me to trace their steps, who haue waded far into the search of this cause, hauing very litle hope to goe further. The first opinion was of the *Stoickes*, who supposed the whole World to be a great liuing creature, composed of diuerse Element, which inioyes both breath and life: This liuing creature they imagine to haue his nostrils placed in the maine Ocean, where by drawing in, and sending forth breath, the *ebbing* and *flowing* of the Sea is caused: but this seemeth rather to be a *poëticall* fiction, or *Allegory*, then any conceit of a Philosopher. *Apollonius Tiansus* was of an opinion, that certain Spirits either vnder, or aboue the Water, breathed into it this motion. *Timæus* taught the cause of this moisture to be the riuers breaking into the Ocean by the great mountaines; *Plato* thought that it was made by the swallowing vp of the Sea into a gulfe or hole, which being againe cast out, was the cause of that motion in the Sea. *Selencus* the *Mathematician*, which affirmed that the Earth was carried round with a perpetuall motion, thought

thought that the Moone was turned round with a motion contrary to the motion of the Earth; and from this to proceed that motion of ebbing and flowing of the Sea, whereof we now treat. What *Aristotles* opinion was concerning this matter, is an vncertain conjecture; forasmuch as litle or nothing can be gathered touching this point in controuersie out of any booke, which is certainly known to be *Aristotles*: for the tract of the propriety of Elements, where the cause of this motion is ascribed to the *Moone*, is judged to be none of *Aristotles*, but of some later Author. Yet *Plutarch* impleth on *Aristotle* this opinion; that this motion of the Sea should come from the Sun, because by it are raised vp many windy exhalations, which should cause the Sea to swell, blowing into the great Atlantick Ocean. But this opinion is charged by *Patricius* of a threefold error: 1 That it should proceed from the Sun; 2 From the wind; 3 That it is only in the *Atlantick* Sea. He saw (saith *Patricius*) that in the *Atlantick*, which he could not in the *Egean* Sea at home and neare *Athens*. For 1 No wind blowes so regularly, that for one six houres it should blow forward, the other six houres backward: for the wind oftentimes blowes many daies the same way without ceasing; yet is there not one only flowing or one ebbing in the Sea. 2 The *Sunne* stirres vp sometimes windes, and sometimes stirres them not vp. But of a perpetuall effect which is daily, why would this Philosopher giue a cause meerely violent, and not quotidian, which notwithstanding would haue nothing violent to be perpetuall? If the Sea be somewhere moued naturally by other motions, as the *Euripus*, (which is said to be his death) wherefore will he deny this motion to be *Naturall*, seeking out an externall cause of this effect? But all this while our *Platonick* Philosopher seemes to fight with shadows: for what judicious man can imagine so judicious and wise a Philosopher as *Aristotle*, should so grossely ouershoot himselfe to father this opinion? I should much rather belieue that no such opinion is to be found in *Aristotle*, at least that it is indirectly related: which I the rather belieue, because one *Casalpini* a late Writer, as well opposite to *Aristotle*, as the

other hath related *Aristotle's* opinion otherwise; to wit, that the ebbing and flowing of the Sea, is deriued from a double cause: whereof the one is the multitude of *Rivers* bringing in a great force of waters into it: whence it comes to passe that it flowes only towards one part, which is the lower, as it happens to the *Mediterranean*; For the *Aegean* and *Pontick* Sea, with *Maotis*, flow into the *Tyrrhene*, and not on the opposite side: The other cause he makes to be the *libration* of the whole Sea: for it is often turn'd from one side to the other, which in so great a vastnes seemes but litle; but in straights & narrow places much more. So that *Aristotle* (saith *Casalpinus*) would haue that to agree to the Sea, which vsually happens to a paire of ballance: which hauing receiued the beginning once of their motion, are inclined sometimes this way, & sometimes that way, by reason of the equality of the weight: for if the weight on one should ouercome, the whole would incline that way, and would not rise vp on the other side. But against this opinion imposed on *Aristotle*, *Casalpinus* not without good reason, excepts, that the *Superficies* of the Water being *Equidistant* from the Center (as is supposed by *Geographers*) no reason may be giuen why it should incline more to one side then another, hauing once obtained his true place: sith according to *Aristotle's* own grounds, no violence can be perpetuall. To which I may adde another answer, that no satisfactory reason can be alleadged, why it should alwaies obserue so true and just periods of time in it's motion: sith all *Rivers* are sometimes encreased, and other times diminished according to the season of the yeare, and variety of the weather: wherefore the said Authour, which impugnes this opinion, hath framed another conceit, grounded on the *circular* motion of the Earth, which he explaineth in this sort. It agrees to reason (saith he) that the Water should not altogether follow the motion of the Earth, but should in part be driuen back, and in part flow besides: for since it is of a moist nature; while the Earth is carried from the Aire about it, the Water is somewhat left behind; as wee may see in a small vessell, which is more large then deep: for if it be moued forward, the

Water

Water will leap back to the opposite part, & will oftentimes poize it selfe hither & thither, seeking an æquilibration: when therefore the Earth is a litle caried forward, & the water (as it were) left behind, being out of his *Æquilibrium*, or æquall poize, it will run to the other part, but beyond the true poize; for the violence of the motion impressed into it in the beginning, from thence, for the same cause, it will tend againe to the opposite part, doing this oftentimes, seeking an æquall weight, wherein it may rest: so that if the Earth should at any times rest from her naturall motion, the Water would also leaue off the *Libration* to and fro. But because the circumsolution of the Earth is imagined to be perpetuall, the libration of the sea is also perpetuall: so far forth then that this motion is of the continent or Earth, it is only accidentall in the Water, neither besides his proper nature, neither according to nature: But so far forth as the Water is in some sort moued in the Earth, it may be said to be according to nature: for it alwaies seekes the lower place, because it cannot æqually follow the motion of the Earth. Hence they giue the reason, why this motion is not perceiued in Lakes and Riuer, as well as in the maine Ocean: for sith the motion of the Earth is not very sensible, it cannot be perceived but in a great masse of waters. The reasons to confirme this opinion, besides the refutation of other opinions, are chiefly these two. If the Water by it selfe should be mou'd without the motion of the Earth, it must needs be moued either *according to*, or *against* his nature. But neither of them can be graunted; First, if according to Nature, there would not be one only motion of one body according to nature, but many, which is denied by *Aristotle*; If besides, or against Nature, some violent motion would be perpetuall, which also seemes absurd: wherefore it must needs follow, that the sea should move accidentally: For sith the Water is contained outwardly of the Aire, internally of the Earth: And that part of the Aire which toucheth the Water is of *Aristotle* called *Stagnans* or standing still, not flowing, as that which it aboue the Earth, but is only troubled variously with windes. This libration or motion of the Water

cannot be caused by the winde or Aire, wherefore it must proceed from the motion of the Earth. The second reason may be drawne from the quantity of tides in divers places of the Earth, for it is found by experience, that the Water swels higher and greater in the *maine Ocean*, then in other *lesser Seas*: For it is observed, that about great *Brittaine*, it mounts sometimes about 80 cubits: also it oftner ebbes and flowes in lesser currents, because the spaces of this libration are shorter and straighter: or because besides the motion of ebbing and flowing, which the *Mediterranean* seas partake from the *Ocean*, at *Hercules Pillars*, they haue a proper libration in their owne channels: whence it comes to passe that in some narrow seas, as in the *Euripus*, besides *Euboia*, the sea seven times a day ebbes and flowes: whereof there can no sufficient reason be giuen from the motion of the *Moone* or other cause whereto other Philosophers ascribe this effect: This opinion of *Casalpinus* seemes to carry great likelihood of reason and congruity with experience: yet because it is grounded on the circular motion of the Earth, which seemes a paradox to most men, I dare not warrant it otherwise then probable, neither can it well stand with the grounds of our *Magneticall* Philosophers, because they affirme the whole spheare of the Earth and Water together with the Aire to moue round with one *Vniforme revolution*, in such sort as one should not moue to the opposite part, or stay behind the other; as they would haue it heere to doe. There is yet another opinion more commonly defended in the schooles of naturall Philosophers; that this motion of the sea is to be ascribed to the *Moone*, as the principall cause: others againe, as they admit the *Moone* to haue her operation in this effect, ioyne other causes to it: and indeed this seemes more probable: for there want not arguments in *Patritius* and other later writers, to shew that the *Moone* cannot be the sole cause of this motion: First, because this motion is not observed in all seas, Lakes, and Rivers, whereon neuertheless the *Moone* hath the like dominion: But experience shewes the contrary: for besides fresh Rivers it is manifest by observation of trauailers, that this ebbing & flowing

flowing is not to be found in the *Hircan*, *Mantian* and *Dead sea*: also in *Meotic Palus*, in the *Pontick*, *Proponticke*, *Ligurian* and *Narbon* streytes, neither in the *Tyrrhene* seas: Moreover it is not observed in a great part of the *Red sea*: Neither can the *Narrowness* of the channell excuse it, because these seas are great, and also for the most part within the *Tropicks* of *Cancer*, and therefore exposed sometimes to the perpendicular beames of the *Moone*. Secondly: If the *Moone* should by her owne force excite and moue these waters, then would it moue those seas, which it doth moue, *Altogether* and not only in parts. The contrary whereof we may find: First in the *Red Sea*, which in the beginning and end, *Ebbes* and *flowes*, but in the middle not at all: moreover the *Mediterranean* sea ebbes & flowes as one sea, on all the coasts of *Africa*, wherein it is in a sort divided; and yet those seas, with which it is ioyned, as the *Tyrrhene*, *Ligurian*, and *Gallican* Seas, feele not any such motion. Thirly; it is objected, that if the *Moone* were the only cause of this *Flux* and *Reflux* of the sea, then those seas, which are said in whole to moue, should equally flow in height: but this is contradicted by experience: because some flow higher, and some lower. As for examples: The *Adriaticke* sea in the inmost creeke neere *Venice* swels neere foure foote in height: but the rest of it, not about two foote: which increase is likewise observed in the *Aegean*, *Cretian*, *Ionian*, and *Cyprian* Seas, also the *Syrian* and *Egyptian*, even to *Tortus Ferina*: But from *mons pulcher* to the *Herculean* streytes, it increaseth about two foot in length: But without these straights, the same Ocean by the coasts of *Portugall* and *Biscay*, and *France*, the Sea riseth vsually to 15 foot in height; and neere the coasts of *Belgia* and *Brittaine* 18 foot: At the confines of *Bristol* to 60, and thence to the borders of *S. Michael* to 50: But at the coasts of *Ethiopia*, neere the *Atlantick* shores, it riseth not higher then in the *Adriaticke* Sea: But neere the Ilands of *Madera*, the *Canaries*, and *S. Thomas*, it surpasseth not the height of *Venice*: But in *America*, on the hithermost coast from *Florida*, *Sinus Mexicanus*, the coasts of *Brasile*, and *Paria*, more then three thousand leagues, euen to the

the *Magellane* straights it increaseth almost to two *Palmes* bredth: but farther South to *Panama*, and all those Southern shores, the ebbing and flowing is of an excessive hight, as may appeare by the coasts of *Cambaia*, *India*, and *Taprobana*: Thirdly, if the Moone by a naturall vertue should moue the Waters of the Sea, then would it moue the *Ocean* and the *Mediterranean* Seas in the course of windes, with the same Fluxe and Reflux in the same windes. But this thwarts experience, which is thus proued: The *Mediterranean* Sea, when as it flowes in the *Adriaticke*, *Ionian*, and *Sycilian* Seas, the Water flowes towards the Land, when the Moone is (as the Marriners speake) in *Sirocco* & in *Maestro*; but ebbes or flowes back from the Land, when it is in *Graco* atq; *Garbinio*: And contrary wise the *Ocean* swells when the Moone is in *Graco* & *Garbinio*; but asswageth it selfe againe when it is carried in *Sirocco* & *Maestro*. Fourthly, if the ebbing and flowing of the Sea should follow the Moone, then all places in the same distance should ebbe & flow alike at like houres. But the contrary is proued by an experiment of *Patricius*, who reports, that at the same houre places distant 20 degrees, haue bin seen to ebbe or flow alike, and the places betwixt also to vary and obserue no just proportion, Fourthly, if these Surges should be stirred vp by the Moone, then the same superficies of the Water the same houre should be carried by the Moone: but this is contrary to the obseruations of Marriners, who haue obserued, that on the *Norman* coasts, and that of *Picardy* to *Calice*, the Tide happeneth the ninth houre from Mid-night: but ten miles from the shore not a full houre, but at the twenty and sixt mile from the middle of the channell, and vnder the same Meridian at 22 houres. Fifthly, if the ebbing and flowing should proceed from the Moone, then should the Water at the same houres increase and decrease: but this is opposite to obseruation: for at *Venice* the Sea is knowne to flow sometimes for seuen, sometimes for eight; but ebbes in fewer houres. But about the mouth of the Riuer *Senega* in the *Atlantick*, it is comming in foure houres, but goes not back vnder eight: so about *Gozumnie Ostia*, the Tide is comming in

I mean that which is gone

in seven houres, but goes back in five. Sixtly, if the Waters flow by the *Moone*, then should they be drawne and carried by the light of the *Moone*: because all action is by a touching, and the *Moon* toucheth the Water by her light: but it is found by experience, that at midnight, when the *Moone* is most distant in her light, our seas doe no lesse ebbe and flow then when it is present: & so the Seas neare the *Antipodes* doe ebbe & flow, when the *Moon* is present with vs. 7^{ly}, if the *Moon* were the onely efficient cause of this motion, then the same light being present the same agent moving, the same effect should necessarily follow. But we find that it produceth two, contrary one to the other: because in her ascent to the Meridian it is supposed to lift vp the water, but a litle declining from the Meridian, it is thought to deposite & assuage the waters. 8^{ly} if this effect were ascribed to the light of the *Moon*, then when the *Moon* shines not, there should be no such motion, because contrary causes produce contrary effects. But we obserue the same ebbing & flowing in the conjunction or *New Moone*, when she hath no light, as in the full *Moon*, when with full face she beholds the Sea: for in both these times we haue highest tides. These & many more arguments are urged by *Patricius*, to shew that the *Moon* cannot be the cause of this motion in the Sea: of the other opinion, that this effect is ascribed to the Sun, amongst others I find the chiefe patron to be *Telestus*, who taught that the Sea was moved in this wise, because it would auoide the operation of the *Sunne*, fearing lest it should be too much dissolved into vapours, and so perish. But this opinion seemeth far more weake then the former. For first I would aske concerning this motion, wherein it is thought to auoide the *Sun's* heat, whether it be *voluntary*, or *necessary*? It cannot be *Voluntary*, or a free action, because the Sea is no liuing creature, to which only such a motion is incident: If it be *necessary*, then it is *Naturall* or *Violent*: It cannot be *Naturall*, because according to *Aristotle*, one Body can haue but one *naturall* motion, but the Water being a simple Body, hath another motion to fall downwards towards the Center: wherefore it cannot also admit of this. It cannot be *violent*: first, because no violent

lent thing can be *perpetuall*: Secondly, no cause can be thought vpon *Externall*, which should cause this violent motion: and if any such cause there be found, then is not this of *Telefius* the first and principall cause, sith it is referred to a farther cause: Thirdly, no cause can here be shewne according to this opinion, why all other waters, as fresh Riuer, should not likewise strue to hide themselues fro the face of the Sun. Fourthly, he should giue a reason why in the *Belgick* and *Armoricke* shores, which are far more distant from the Sun, the same motion is no lesse eminent then in *Taprobana*, which is subject to the *Torride Zone*; and why in the Iland of *S. Thomas*, which is immediatly vnder the *Equatour*, there is not a greater working of the Water then at *Venice*. Fifthly, that which *Telefius* brings to confirme his opinion, is no lesse warrantable then the maine point in controversie. In the Summer (saith he) the fouds are lesser, because the *Sun* riseth vp *thinner* vapours, which are easily dissolued: But in the Winter they are lesse, because the *Sun* is of leust force, and so raiseth vp fewer vapours to worke vpon the Sea: But both these maters are proued false by experience: first, because in the Summer we haue as great a working of the water as at other times: In the Winter also as great, or greater. Secondly (saith the said Authour) in the full Moone the motion is greater, because the much light arising from the Moone, drawes vp many vapours. In the *New Moone*; because the Aire being refrigerated, the internall Heat of the Sea collecting it selfe, is made stronger with more vapours: In the *quarters* of the *Moone*, because there is not much light cast from the *Moone*; and the Heat of the Sea is not so much collected by the externall cold of the Aire: To all these maters we may easily answer: First, how can the Moone bestow any light on our Seas, when she is with the *Antipodes*? Secondly, where he saith, that the internall Heat is gathered together, and made stronger by externall cold; 1 First I aske how the Sea can send forth these vapours; if the vapours kept vnder doe raise the Sea vp; or if the Sea swell with these vapours in her wombe, how can she let them out? 2 How will he proue the Sea naturally to be hot, sith it

is one of the cold Elements? Thirdly, where he saith, that the light of the Moone is but in halfe imparted to the Sea; why should not the Sea proportionally in half be stirred vp? wherefore *Patricius* and *Casman* finding neither the Sunne nor the Moone of it selfe to be a sole and sufficient cause of this motion, hauing joyned them both together in this causality, and added besides other particular causes: first (say they) there are two kind of causes concurring to that effect: either *Uniuersall* and *externall*; or *Particular*, *internall* and next causes. The *Uniuersall* causes are two; to wit, the *Sunne* and the *Moone*. The *Sunne* (saith he) with the heat of his beames and light doth *conserue*, *vivificate*. and stir vp to action, the *Internall* and *originall* heat in all things here below. This Heat being stirred vp and vivificated, all things are made fit for motion, and being so accommodated, are stirred vp to motion, as if from an *Internall* life they should be promoted to an *Externall*; for as in the *primary* life of things, the motion and action is showne in the *Effence*; in the *secondary*, the action and motion outwardly in respect of other things: so the first and originall heat of the Sea, cherished, and stirred vp by the external heat of the Sun, drives the Ocean, and moues it to action. The *Moone* also cherisheth, preserveth, vivificates, nourisheth, and stirres vp to motion, all these earthly humours and moistures: and as she dayly by houres beholds the Sun as her darling, & by him is (as it were) big-bellied with lively seedes, so she beholdes her loue, the *Ocean*, dayes and nights, and fills the Ocean with these seedes which she receiues from the *Sunne*. But this cannot be performed without her motion, without the diffusion of her light, without the effusion of her influence & seedes; wherefore it cannot otherwise be, but all our humours and moistures should be made fruitfull, conceiue life, bring forth, beare fruit, and be stirred vp to life and motion, by the motion of the *Moone*, through the *Aspect* of the Moone with the *Sun*, with the *Earth*, with the *Ocean*: wherefore all lower moistures are subiect to the power of the Moone: Notwithstanding all are not equally vnder her dominio; sith all are not of the same substance, of the same Rarity, or density, or of the same Heat.

This much of the vniuersall causes of the motion of the Sea, according to this opinion. The particular or nearer causes are such as are found in the Nature of the Sea it selfe: and these are two: the *fluidity* deriued from the *Radicall* and first moisture; & the *salnesse* drawne from the *originall*, & inbred Heat in the Sea. *That* is most subject to the dominion of the *Morne*, *this* of the *Sun*: The saltnes therfore of the Sea seemes the nearest & most proper cause, & no other common Nature, why the Sea should be stirred with so many motions: for no fresh water is moued with so many, nor suffers any such Flux and Reflux as the Sea. Then must the saltnesse be the nearest and most proper cause: But by what meanes doth it worke? It is answered by *Patricius*, that salt water hath in it more heat then any fresh water whatsoeuer; And though spirits be hid in all moisture; yet farre more in salt, then freshnesse: wherefore from these spirits existing in the salt humour, is the Sea turned and tossed with so many motions: amongst which, the chiefeft & most remarkeable of all is that of the *Ebbing & Flowing* of the Sea: for by these motions, the Sea as a Terrestrial Heauen, followes and imitates the superior; wherefore it seemes euident, that from such a motion should be deriued the motion of the Sea. This opinion seemes to haue great shew of probability, & to be more sound then all the rest: but whether it will in euery part satisfie, I much doubt: yet must we embrace it, vntill such time as a better be found out.

2. *All seas doe not ebbe and flow alike: Neither the same at all times.*

That a great disparity is found in diuers places of the sea, concerning the afflux and reflux of the Water, is manifest out of many instances, we haue shewed in the former proposition: it will be enough in this place, to giue some reasons for this variety. This disparity then is found to be two-fold; for some seas neither ebbe nor flow at all; others ebbe and flow: Again some ebbe and flow more, others lesse. Again in respect of time we shall obserue besides daily comming and going

going of the Waters, Weekly and monethly changes, of all which branches we shall haue occasion to treat hereafter according to those footestepps, which I find in the best writers. First therefore the want of this motion of ebbing and flowing in the sea, is by some Authors ascribed to many particular causes. 1. The *Freshnesse* or want of salt in the Water. 2. The *Crafftitude* and thickenesse of the Water. 3. The ouermuch *thinnesse* of it. 4. The extreame *depth* of it. 5. The *narrownesse* of the *Channell*: All which either ioyned together, or in part, may hinder, if not altogether take away, the ebbing and flowing of the sea in those parts: which we shall the better vnderstand, if we instance in some particular seas most remarkable: The *Caspian* sea is reported to be of this condition (although some haue doubted,) that it neither *ebbs*, nor *flows*: This affection is imputed to two causes: First, The want of *saltnesse*; Secondly, the extreame *depth*: By the former it is vnapt to generate *spirits*, which should giue a motion: And by the later, the *Sunne-beams*, which concur to the stirring vp of these *spirits*, are hindred from piercing to the very bottome of the Water. That this sea should little partake of *saltnesse*, may easily be perswaded; forasmuch as 80 Rivers of fresh water, with 5 Lakes of no small quantity, are disburthen'd into this sea: Among the which are *Ochus* frō the *East*; *Cyrus* frō the *West*, *Araxis* from the South, falling into it with 40 Inlets; and *Volga* from the North, running into it with 70 Inlets. All which fresh Rivers, some of them exceeding great, must needs make this sea very fresh. To this may be added, besides the authority of *Contarenius*, confirming this by two other reasons: First the *Trouts* and *Lampreyes*, which is a kind of fish altogether delighting in fresh Water, are there taken in great abundance: Secondly, that on a certaine coast of it, the Water of it's owne accord congeales into salt: The reason whereof is, because *salt* Water mixt with *fresh* will more easily *coagulate* and congeale into salt. The depth of this sea is also sufficiently warranted by such as write of it, especiall the former named *Contarenius*. Secondly, the Lake called *Asphaltus* is thought neither to *ebb*, nor *flow*: which besides these

reasons alleaged from the *Caspian Sea*, may be ascribed to the *thicknesse* of the water, not suffering any thing to sinke into it: So that for the crassitude of it, it must needs be heavier then other Water, and so, more vnapt for motion. Thirdly, it is recorded by some that in the inmost creeke of the *Red sea*, there is a motion: and so in the mouth of it, by reason of the *Ocean*; but in the middle no such matter is to be observed: which strange effect, some ascribe to the *Thinness* of the Water (one of the causes aboue named) begetting *fewer* and *weaker* Vapours and *Spirits*: which either freight-way breath out, or are too weake to raise vp the Water. This thinnesse is confirmed to be in that middle part of the *Red sea*, not only out of the authority of *Iohn Barro*, out of the experiments of *Iohn de Castro*, which found this Water to be clearer and liker to Christfall, then that of other parts; but also by the cleare perspicuity of it: For in almost all the sea may the bottome plainly be seene. Fourthly, we read the like of the *Baltick* sea: that it neuer ebbs or flowes, which *Bartholomew Keckermann*, that countrey-man, ascribes, 1. To the *Narrownesse* of the channell: 2. To the *depth* of it. 3. To the *northerne situation*: which cause I thinke he might well haue spared, considering that more *Northerne* seas then that, both ebbe and flowe. Fifthly: it is reported of *Maotis*, *Pontus* and *Propontis*, that they flowe from the one to the other, but neuer ebbe: For *Maotis* flowes into the *Pontick* sea as from the higher place into the lower: and the *Pontick* into the *Propontick*, and *Egean* for the same cause, but returne not back againe. But besides this cause of this decliuitie of the ground, it stands with reason, that the Water should be fresher then that in other places of the sea: For first, all of them receiue into them many and great Rivers of fresh Water: for *Maotis Palus*, besides other, partakes of *Tanais*. Into *Pontus* fall according to *Arcanus* report about 52 fresh Rivers: whereof the chiefe are *Ister*, *Hispania*, *Boristhenes*, *Tanais*, *Phasis*, all great currents. Secondly the forenamed fishes, which delight in fresh springs, are heere also found in abundance. Besides this freshnesse (if we beleue ancient writers, as *Pliny* and others) it is a sea of ex-

traordinary depth, so that for this cause some part of it was called *Negripont*, or the *black sea*: Which blacknesse was by some, thought to arise from the depth of it: whereia in many places, they could sound no bottome. Sixtly, it is testified of the *Tyrrhene*, *Ligurian*, and *Narbon* seas, that they suffer not this motion: The cause of which is only ascribed to the extreame depth; for few or no Rivers are disburthen'd into it, except *Rhodanus*: We are in the next place to shew, why this working of the sea is more in one place then in another: The reasons whereof (although many be thought on) are chiefly reduced either to the excesse of *saltnes* in the water, or the narrownesse of the *channell*, into which from an open place the sea is to be disburthened, or the shallownesse of the shore: All which either cōcurring together, or taken by theselues apart, may cause the sea to swell more in one place then another; which may, as the former, be proued by diuerse Instances. Foure Seas are more particularly noted to flow and swell higher then other. The first is that compasseth about *Europe* from *Hercules pillars*, which according to diuerse shores, takes diuerse names; as the *Portugall*, *Cantabrian*, *Gallican*, *Felgicke*, and *British* Seas. And in the New World, or *America*, the Southerne Sea shalbe the second: The third is that of *Cambaia* and *India*: The fourth is that which compasseth about *Taprobana*: for the three last, the causes fore-specified, seeme manifestly to concur: for *Taprobana* is reported by *Pliny* to haue a shore not aboue sixe paces deep, and the Sea to be greene and ouergrowne with weeds, insomuch that the tops of the weedes fret their ships; and later Writers report, that the Land is knowne to augment the confines by reason of the shallownesse of the Water: so as we haue shewed that some Seas neither ebbe nor flow by reason of the depth of the channell; so on the other side must it follow, that other Seas ebbe and flow more by reason of the shortnesse and shallownesse of the shores: for of contrary causes, proceede ordinarily contrary effects. Moreouer it stands with experience, that in any Water or Sea, where the flood is stopped and hindred by quick-sands, it returnes with greater force, as it were enra-

ged.

ged, & swells so much the higher, which is the cause why in the coasts of *Cam'ania* it is lifted vp so high, because the shores are so shallow, and so short, and expos'd to impediments, that in the ebbe, the Sea runnes backe many miles, and leaues the sands vncouer'd: Whence it must needs returne with greater violence. This also is found in the *Indian* Sea, and neare *Panama* in the Southerne Sea, where the Sea running back for two leagues, certaine *Ilands* and *Lands* are left naked; so that in these three Seas here named, the Sea seems to enlarge it's limits in bredth more then in other places; to which we may ascribe this effect. For the Seas about *Europe*, we may pronounce also, that for the most part they haue short & shallow shores, as may easily appeare in the confines of *Belgia*; But it may be objected of the *English* shores, that they swell very high, albeit the depth of the Water in the middle is found to be 144 foot: Here must we haue recourse to the other cause, the flowing of a large & wide sea into a narrow chānell: for the large torrents of water running swiftly into a narrow chānell, being hindered on both sides by the shores, frō spreading it self in bredth, is enforced to swell in height: so that the effect is rather to be ascribed to the violence of a great current, embosoming it selfe into a streite chānell: which may more evidently shew it selfe in 3 instances: For in the streite chānels of *Zeland* and *Holland* it is lifted vp about three foote: At *Bristoll* in *Eng'land*, by reason of a greater force of Waters running from the sea into a more narrow chānell, and seconded by the maine Ocean at the back, it swells to the height of 60 foote: In the *Armorean* seas, where larger seas are emptied into more narrow streites then the former, it increaseth to 90 foote: Out of which experiments may we plainly collect, that to the increase of the motion of the sea besides the saltnesse of the Water, two other causes are concurring; to wit, the shallownesse of the shore, and the streitnesse of the chānell, wherein a great and large sea is to be exonerated. This may lastly be farther illustrated from the disparity of these seas with others, for in the *Adriatick*, *Egean*, *Ionian*, and almost all the *African* seas, the sea seldome swells to so great a measure: whereof the

the cause is aswell the *depth* of the seas, as the *equality* of the shores: for as the depth is a cause that sometimes it flowes not at all, and the inæquality and shortnesse of the shore that it flowes high: so a meane hight of the Waters from the bottom, and a more æquall figuration of the coasts may be a cause of an indifferent working of the Water. Hitherto we haue shewed the variety of motion in the sea, in regard of the diversity of places: we are next to speake some thing concerning the variation of it in regard of the times, which, though it properly appertaine not to Geography, yet am I loath to leaue it out, because the discourse is pleasant. Concerning which point, the marriners make six degrees of change in the tides according to the times. First *diurnal*, whereof we speake in this discourse: The second *Hebdomedary*, or weekly which *Possidonius* called monethly or weekly; because it is distinguished by severall weekes of a moneth: but carries not till the end of the moneth: For it is found by experience of Navigatours that a day before the *coniunction* of the *Moone* with the *Sun*, and the day of *coniunction*, and a day afterwards, the seas in the *maine Ocean* haue their greatest *flowes* and *ebbes*, being lifted higher and laid lower downe, & then the tides are most swift: The *fourth* day from the *coniunction*; the tide is lesse and lesse swift: The *fift* yet lesse then the former; and the *sixt* day lesse then the *fift*: But in the *seventh* day, which is a day before the *Quarter*, and in the *eight* following, wherein it is *halfe-faced*; and in the *ninth*, which is a day after the *quarter*, the sea is, as it were, dead, not much stirring, neither much ebbing or much flowing; which was (as it seemes) only observed by *Pliny* in the *Æuboian Enripus*; but whether it so happen else-where, I leaue to men experienced in these matters; This motion as it doth *encrease* according to the age of the moone: So it is said proportionally to *decrease* againe. The *third* motion is *monethly*, which seemes in the time of the *coniunction*, wherein the sea tides are highest and swiftest. The *fourth* is called *motus semestris* or *six-monethly*, happening at the times of the *Æquinoctial*; differing one from the other like monethes; The *fift* is called *Trimestris*,

because it happeneth only in three moneths distance. The last is *Annall* which *Patricius* witnesseth that himselfe saw in *Liburnia*, in the moneth of *Ianuary*. These motions I carelesly passe over, because the distinction seemes to me full of vncertainty and scarce warranted: and such experiments as are brought for the prooffe of it concerne rather particular places, then the generall nature of the sea.

3 Hitherto of the generall motion of the sea:
The *Speciall* is that, which is observed in some speciall places.

1 It is probable that the sea is carried some-where from East to West, and some-where from North to South, and contrariwise.

It hath beene a received opinion amongst Philosophers of this later age, that the sea by the rapture of the heaves should be moved round, as it were, in a diurnall course: which they haue laboured to proue by diuers experiments. First, because it is observed by mariners that a ship can well saile from *Spaine* into *America* with an indifferent winde in 30. dayes, when she can hardly returne vnder three moneths, which they ascribe to the circular motion of the sea: For a ship going from East to West sailes with the Water, but from West to East against the streame, so that the one must needs be swifter and the other slower. Their second experiment to confirme this point, is of a ship, sailing from *Spaine* to *Holland*, which may as they say swifter returne back then goe thither. To this motion of the Water from East to West, *Lincolne Scaliger* hath added another, which he would haue to be from North to South, from *Terra Laboratoris* Southward. But *Patricius* not denying these motions, would haue many more in diuers Seas, not admitting any vniuersall circular motion enforced by the heavens, but various motions diversly disposed in diuers Seas, for which he giues many instances, some whereof we will heere relate. First going about to disproue
Sea-

Scaliger's opinion and experience, hee brings the experiment of the *Portugall* Nauigatours, who testifie that they came from *Mosambick* on the side of *Madagascar* into *Malebar* in 28, sometimes in 30, other times in 35 daies: which is farre from the accompt of *Scaliger*, who would not haue a ship to passe it vnder three moneths, out of which he labour'd to proue this motion of the Sea, because the shippe was longer a going then returning. The second experiment he takes from the obseruation of one *Iohn Enpolius*, who willing to passe from the port of *S. Blasius*, which is beyond the cape of good hope in *Africk* to *Melinde* towards the Indies, could not goe forward by reason that the currents, (as they call them) droue them back from *Melinde* to *Pate*, a towne by this side of the Indyes: whence he would conclude that the Water should in this place rather runne from West to East towards the Indies. The third experiment is drawne from the testimony of *Thomas Lope*, who when he was to passe from the Cape of good hope towards the Indies, testifies that the current of the Water was so violent, that it oftentimes leapt into the fore part of the shippe. The fourth is from the testimony of *Iohannes Guistanus*, who putting forth from *Tidor*, came into *Spaine* before the sixteenth moneth: This iorney from *Tidor* to the cape of good hope, contains 55 leagues, which makes 1650 miles: from this to the Iland of *S. Helena* by the relation of another pilott are 1400 miles: from whence to the Equinoctiall circle are 1800 miles: from whence to *Spaine* by the computation of degrees, are not about 1520 miles: of all which the summe is, 7114. Now if we take out of sixteene moneths 49 dayes, wherein the ship against the cape of good hope, was carried hither and thither (which the mariners call *Voltegiare*) & 70 other daies wherein it stood still in the coasts of *Gninea* in *Melacia*, there will remaine a whole yeare spent in this iorney: which dayes if we divide by those 7114 miles, there will be allotted to euery day no more then 19 miles. which evidently shewes that this iourney was most short in respect of the swiftnesse of the Nauigations. For if the Ocean should driue his currents

to *St Helena* even to the west, they had ended their journey in a far lesser time, because those currents (as they say) carry the ship. But this journey was accomplished very slowly: wherefore the currents were not carried from *East* to *West*, as *Scaliger* relates. Likewise from sundry other experiments, he goes about to proue that it constantly cannot be obserued to flow from *North* to *South*, as the said *Scaliger* affirms, but that it is various according to diuers places. Neuerthelesse, that the Sea should haue a perpetual current from the *Poles* towards the *Æquatour*, seems to stand aswell with Reason, as Experience: For allmen must needs confesse, that the motion of the Heauens vnder the *Æquatour*, must be much swifter then nearer the *Poles*, because the circles of it are greater neare the *Æquatour*. Now by howmuch swifter the motion of the Heauen is, by so much more is the Rarefaction of the *Aire*, or other Elementary bodies right vnder it: whether it be *Aire* (as it is most probable) or *Fire* as *Peripateticks* imagine: But howsoeuer we determine that controversie, it must needs be that the *Aire* must suffer Rarefaction, answerable to the swiftnes of the motion: if not immediatly by the swift motion of the Heauens, yet by a consequent by the greater seruour of the *Fire*, which vnder the *Æquatour* must needs be greater and of more force then about the *Poles*: whence the parts of the *Aire* vnder it, must partake more degrees of Heat, and by necessary consequence suffer a greater Attenuation. 2 The *Sunne-beames* being darted perpendicularly, cannot choose but attenuate and rarifie the *Aire* mere vnder the Line, then in places more declining to the *Poles*. This ground thus laide, these two consecutaries will follow: 1 That the *Aire* thus attenuated, must needs take vp a larger place then it before possessed, which cannot be but by enlarging it self towards either Pole, either *North* or *South*; whence the parts of the *Aire* in those places must be more thickned and condensated. 2 That these parts of the *Aire* carried towards the *Poles*, and meeting with the cold Regions of the *North* and *South*, must by condensation turne into water, and so fall down in *Raine* or *Snowes*; whence the Water

encreasing neare the Poles perpetually, must haue a perpetual current towards the *Equator*, where they are againe exhausted in vapours by the Heat of the *Sunne*; in such sort, that as well the parts of the Sea betwixt themselves, as the waters in regard of the *Aire*, may proportionally maintaine themselves by mutuall transmutation. To this reason some haue added another, that the *Sunne* sojourning in the *Southerne* Signes, is nearer to the Earth, then when he is in the *North*; by the whole *Latitude* of his *excentricke*, and therefore of greater force to draw the water toward the *South*; But whether this Reason be of any great force, I will not spend time to dispute: let euery man vse his own iudgment. It seemes to me a conjecture not improbable, that these currents may be also varied according to diuers seasons of the yeare; as also according to diuers *channels*, by diuers crossings and doublings of the Tides, as we find in diuers places; but I will not be too bold in this opinion, because I loue not to walke without a guide in these vncertainties.

4 Of the Naturall motion of the Sea we haue spoken: It remaines we speake somewhat of the *Violent*: The *Violent* motion is that which is stirred vp by windes.

The consideration of windes is either *absolute* or *respectiue*: Absolute I call that wherein the Naturall effects, and properties of the winds are handled; which properties belong to the naturall Philosopher, they being (according to *Aristot.*) a Naturall body vnperfectly mixt: The *Respectiue* consideration is that wherein the windes are considered in respect to the Terrestriall Globe. This Respect is again twofold, either in regard of the whole Spheare of the Earth, whereof they designe out the points of the Horizon by certaine lines called *Rhumbes*; or else in respect of the *Sea*, to which they giue a motion. The former respect we haue handled in our first book of *Geographie*: The later is more proper to this place; & howsoever the wind is an exhalation, common as well to the Earth

as to the Sea, affecting both with some alteration; yet because it more nearly affecteth the Sea as his proper Prouince and Dominion, and hath for the most part bin most obserued of Sea-men and Marriners; Wee thought fit to treat of it in this place. Of windes some are vncertaine and various, which in all places interchangeably supply their turnes, keeping no certainty or regularity in times or places: others are called, *set* or standing windes, because they are obserued to blow at certaine times and places: of both which, as much as concerns our purpose, we shal speake in these two Theoremes.

1 To some certaine places, at certaine times belong certaine windes.

These winds are by some, called *Anniversary* because they blow at a certaine season euery year; of these there are many kinds mentioned by Nauigatours. The first and chiefeest is that which they call the *Etesian* winde, which is obserued to blow euery year from the Northeast about the rising of *Dog-starre*, and oftentimes continues about 40 daies. This wind drives the Seas from *Pontus* into the *Aegean* Sea, euen so farre as *Egypt*. In the second place may wee range such windes as are called *Chelidonian*, because they arise at the first comming of the Swallows. It bloweth sometimes from the *Direct west*, so that of some it is taken to be the same: Sometimes from the *North west*, so that with others it is accounted among the North winds: These *Chelidonian* winds driving from the North or North-west fill all the *Mediterranean* euen to the coasts of *Syria* and *Palastine*, and continue in the summer time for many daies together. In the third place may we accompt that winde, which *Columbus* perceived on the coast of *Portugall* comming ouer the *Atlantick* Ocean, which at some times of the year was carried higher, at other times cleaving (as it were) to the bosome of the Sea, whence he probably coniectured that it was derived from some moist land, whereon he aduentured on the first search of *America* and laied the first worke of that discovery. Fourthly to these

winds

winds may be reduced those yearely flowings of the *Persian* and *Indian* Seas, which the *Portugall* mariners call *maticus*. The *Persian* Sea suffers such a kind of motion every yeare while the sunne runnes through the *Southerne* degrees, and when he arriveth at the end of *Sagittarius* it is shaken with an extraordinary great tempest: On the contrary side the *Indian* Sea, while the *Persian* is moved, is observed to rest without any great motion; and when the *Persian* is still, it suffers great motion, especially when the Sunne first enters into *Cancer*. This last motion seemes to be not only derived from the *Provinciall* windes, but some other concurrent causes: whether these winds are the cause of the currents before spoken of, is a very disputable point, which I leave to others to search out. Of every set winde blowing a part of the yeare on the coast of *America*, *Acosta* treats at large, to which he ascribes the currents forespoken of in this chapter.

2. The violence of winds makes the Sea sometimes in some places transcend his ordinary bounds.

How farre the sea by violence of windes hath trespassed on the land, many have learned to their greate losse and calamity. It is observed sometimes in the *Venetian* shores, that the Sea driven with winds swells so high, that overflowing all the banks and channels, the Inhabitants are enforced to row in boates from house to house: Their cisternes are infected with *Salt-water*, and their pretious waters in vaults and cellars spoiled. The like hath heretofore beene found (if we will credit Histories) in the *Belgick* Sea, on which the Northwest windes blow with such vehemency and so long that it brake downe the ordinary banks; and in *Zealand* and *Holland* swallowed up many townes with infinite multitudes of people. Which seemes to be warranted by a report, I have heard of many travellers, that in a calme tide the topps of towres and steeples have beene seene above the water. Besides these instances, we may adde the testimony of *Strabo* and *Aristotle* in his

his booke *de mundo*: with diuers other relations of strange *in-
unditions* whereof we shall haue more occasion to speake
heereafter.

CHAP. VII.

Of the Depth, Situation, and Termination of the Sea.

I **H**e *Absolute* proprieties of the Sea
being hitherto passed ouer: wee
will consider next the compara-
tiue: which agree to the Sea no other-
wise then in respect or comparison with
the Earth; which are chiefly three; 1 *Depth*,
2 *Situation*, 3 *Termination*.

2 The Depth or Profundity is the distance
betwixt the Bottome and the *Superficies* of
the Water.

To find out the Absolute depth of the Sea, is a matter of
the greatest difficulty, and by many thought impossible,
in respect as well of the immensity of it in many places where
no line could touch, as of the various places, too many to be
searched out by mans industry: yet where absolute science
failes, there probable coniecture takes place, and is best accep-
ted, which we will venture to propose in this our Theo-
reme.

1 *The ordinary depth of the Sea is commonly*
answe-

answerable to the ordinary height of the maine land about the water: and the whirlpools and extraordinary depths answer to the height of the mountaines about the ordinary height of the Earth.

It hath bin a common received opinion among ancient Cosmographers, that the depth of the Sea being measured by a line and plummet, seldome exceeds two or three miles, except in some few places neare the *Suevian* shores, and some places about *Pontus* obserued by *Pliny*. But as *Breerewood* a worthy late writer obserues, this position is not to be vnderstood generally, but only of the depth of the *Streits* or narrow seas, which were perhaps only searched by the ancients who dwelt farre from the maine Ocean: But another accompt is necessarily to be giuen of the maine Ocean. This being a matter of great vncertainty, we will follow the conceit of the forenamed Author. It hath bin shewed in the former Chapter, that the most probable opinion concerning the manner of the first separation of the dry land from the waters, would haue the Earth by the Creation to be cut into diuers sluces & channels, apt to receiue Water. Now these materiall parts of the Earth, being taken out to giue way to hollownes, were not utterly annihilated, but by an almighty hand set in some other places, making by their addition the superficies of the Earth in such places higher then before: whence by reason it seemes to be collected, that the ordinary Eminency of the height of the Earth about the Waters, should be answerable to the ordinary depth of the Sea. And if Hills and Mountaines be compared, we may set them against the Deepes and extraordinary Whirlpools and Gulfes: And so betwixt the Sea and Land, and the parts of the one and the other we may settle a kind of agreement and proportion: In a matter of so great vncertainty, no man will expect an euident demonstration.

3 The Site is the position of the Sea in respect

spect of the Earth.

Concerning the site of the Sea in respect of the Earth, we must consider the Water and Earth two wayes: First *Absolutely* as they are Elements and solide Bodies: Secondly, in respect of the *superficies* of either: if we consider the whole solide Body of the Water as that of the Earth, we must confesse without all doubt, that the Water hath the higher place, being lighter then the Earth; of which situation we haue spoken in the first booke: for although some parts of the Earth are thought (by most, as we shall proue) to be aboue some parts of the Water, yet is this of no sensible proportion in respect of that vast Masse of Earth, touched vnder the Waters betwixt them and the Center of the World. But the question is here of the *superficies* of the Water, compared to the *superficies* of the Earth vncovered, which should be higher in place; of which shalbe this Theoreme.

1 The *superficies* of the Sea is some-where higher then the *superficies* of the Earth, some-where lower.

There hath bin a great dispute among Philosophers concerning the position of the Sea in respect of the Land, whether it be higher or lower: some haue bin of an opinion, that the Water is higher; which opinion was defended by *Tully*, in his Booke *De Natura Deorum*, where he saith, that the Sea being placed aboue the Earth, yet coueting the place of the Earth, is congregated and collected, neither redounding, nor flowing abroad: which afterwards seems to be seconded by diuers learned diuines, who reducing most things to the supernaturall & first cause, diuers times neglected and ouer-slipt the second: Hence *S. Basil* in his 4 *Homily* on the *Hexameron*, lest the water (saith he) should ouerflow & spread it self out of the place it hath occupi'd, it is comanded to gather it selfe together: otherwise what should hinder the *Red Sea* to ouer-flow all *Egypte*, being lower then it selfe, vnlesse it were manied with the Creators power, as it were with fetters: to which also afterwards seeme

seeme to subscribe *Aquinas*, *Dionysius*, and *Catharinus*, with diuers other Diuines; who held that the first discouery of the Earth, and the gathering together of the Waters in the first Creation, was made not by any mutation in the Earth, but by a violent accumulation of the Waters; being (as it were) restrained and bridled supernaturally, that they could not transcend certain limits and bounds. To confirme this opinion, some reasons are alleaged by moderne Philosophers: first because it is the order of all the Elements amongst themselves, that the Earth, as the heauiest, should take the lower place, and the water should ascend aboue: Secondly, because Marriners comming from the *maine Ocean* to the Land, seeme to see the land far lower then the Water: Thirdly, they alleage that place of *Iob*, where God himselfe professeth, that he hath bounded the Waters, in these words: *Hitherto shalt thou come, and no farther, & here shall thy proud waves be stayed.* But this opinion seemeth very improbable, that God in the first institution of Nature, that God should impose a perpetuall violence vpon Nature: sith we see the Creator in other matters to vse Nature as his ordinary seruant, and to administer the Regiment of things by second causes. Neither were the authority of these Diuines so great in these *Cosmographical* conceits, to ouersway these of the same profession, who could more exactly iudge of these matters. Neither are these reasons of so great validity as to enforce assent. For first whereas *S. Basil* seemes to wonder why the *Red Sea* should not overflow all *Egypt*, if it were not supernaturally bounded; he takes that as granted, which is the question in controversy, that the Water is higher: for which he can produce no other reason, then the Testimony of the sense: but this is very weak, forasmuch as in such matters the sense is oftentimes deceived, as stands well with the grounds of the *perpetuities*: for (as we are there taught) two *Parallels* will in the end seeme to concurre so far as the sight can iudge: Now the Spheare of the *Heauens*, and the Sphericall segment of the *Waters* being parallel the one to the other, will necessarily seeme to concurre in the end: whence it must needs come to passe, that

that part of the Sea must seeme to lift it selfe higher, and contrarywise the *Heavens* will seeme somewhat lower then indeed they are: and this I take to be the true cause why the Sea being seene a great way off, may appeare raised above the land whereon we stand. Another reason may be giuen from the perpetuall *Refraction* of the vsuall *Liaes* comming from the Sea to our sight. For the Aire neare the Sea being alwayes intermix'd with thick watrish vapours rising vp, the Sea must of necessity be presented in a thicker *Medium* by a refracted sight: whence consequently it must seem greater & higher then indeed it is: for as the *Opticks* teach, all things seem greater & higher in a thicker *Medium*. To the other three Reasons brought to confirme this assertion it is no hard thing to answer. To the first which would out of the order of the Elements inforce, that the Water is higher then the Earth; I answer (as before), that if wee intirely consider these Elements amongst themselves, wee must giue the hight to the Water; forasmuch as the greatest part of the Earth lies drowned; for that about beares no sensible proportion in respect of the parts of the Earth vncovered. But here we compare not the 2 Elements intirely betwixt themselves, but the *superficies* of the Water with the parts of the Earth vncovered, habitable: which *superficies* of the earth notwithstanding, this reason, may be higher then the Water: Secondly, where they produce the testimony of the sight; for my own part, I can warrant no such experience, hauing neuer launched farre into the deep: yet if any such experiment be avouched, it may easily be answered out of *opticall* Principles: that coming out of the main Ocean towards the land, by reason of the spherical convexity of the water, interposed between our sight, and the lower part of the land, those land parcels must needs seem less, as hauing some parts shadowed frō our sight: whence it must consequently appeare lower, as couched almost vnder water. Frō the 3^d reason grounded on *Scripture*, whereon our diuines seem most to depend, nothing else is concluded, but that Almighty God hath set certain bounds & limits which the Waters should not passe: These bounds & limits I take not to be
super-

supernatural, as if the water restrained by such a power should contain it self within it's own circuit: But naturall as *chests & hills*, within which, the waters seems intrenched. This opinion therefore being disliked, others haue laboured to defend an opposite position, that the water is lower then the Earth altogether: which opinion beares more cōsonancy with the doctrine of *rist.* & most of our modern Philosophers. The reason hereon this assertiō is grounded, be chiefly these: 1. If the Sea were higher then the Earth, what should hinder the water of it frō flowing abroad, & ouerwhelming the Earth: sith all men will confesse, that the water is by nature disposed to moue downwards to the lower place. If they haue recourse to supernatural bounds, besides that we haue spoken cōcerning the interpretations of such places of Scripture, as seem to fauour this opinion; we answer as before, that it is very improbable, that God in the first creation should impose such a perpetuall violence: secondly, we read that in the vniuersall deluge wherein all the world was drowned; God brake open the springs of the deepe & opened the *Cataracts* of heauen to powre down raine continually many daies together vpon the Earth: Of which there had beene no necessity at all; had the sea beene heaped vp in such sort as they imagine: For the only withdrawing of that hand and letting goe of that bridle which gaue the Water that restraint, would haue beene sufficient to haue ouerwhelmed the whole Earth. The second reason is taken from Islands in the sea, which are nothing else but parts of the land raised vp aboue the water. Thirdly we find by experience, that a ship carried with the like winde is driuen so swiftly from the port into the open sea, as from the sea into the port, which could not be donne if the sea were higher then the land: for it must needs be, that a ship if it were to be carried to a higher place, should be moved slower then if it came from an higher to a lower. Fourthly all Rivers runne into the sea from the inner parts of the land which is a most evident signe, that the land is higher then the sea; for it is agreeable to the nature of the water to flow alwaies to the lower place, whence we gather that the sea shore, to which the Water is brought from the land, must needs be lower; otherwise the Water in running thither,

should not descend but ascend. This opinion I hold farre more probable as being backt by reason, and the Authority of our best Philosophers: yet not altogether exactly true (as we shall shew heereafter.) But *Bartholomew Keckerman* a late German writer holding these 2 former opposite opinions (as it were) in one equall Ballance, labours a reconciliation. In a diuerse respect (saith he) it is true that the sea is higher, and that it is lower then the Earth. It is higher in respect of the *shores and borders*, to which it so comes that sensibly it swells to a Globe or a circumference, and so at length in the middle raiseth vp it selfe and obtaines a greater hight then in those parts, where in the middle of the sea it declines towards the shore: Of which parts the hight suffers such a decrease, that by how much neerer the shore they shall approach, by so much the lower they are in respect of the shore: in so much that touching the shore it selfe, it is much lower then the Earth. For this opinion our Author takes as a demonstration: which he grounds on the 4 chapter of *Aristotle de Celo*, in his second booke, where he puts downe these two positions; which he calls *Hypotheses*, or suppositions; First that the Water no lesse concurs to the making of a Globe or circle, then the Earth: for it so descends naturally, that it doth sensibly gather it selfe together, and makes a swelling, as we see in small dropps cast on the ground: Secondly the Water makes a circle which hath the same center with the center of the Earth: Out of these grounds would our *Keckerman* conclude the water in some places to be higher, in other places to be lower then the Earth: And hence proceeds he to giue an answer to their reasons who haue affirmed the Earth to be higher then the sea: What to thinke of the proposition or conclusion we will shew heereafter, but in the meane space I hold this conclusion not rightly inferred out of these premises: For first whereas he saith that the water by nature is apt to gather it selfe round into an orbe or spheare, I would demanda whether such a round body hath the same center with the world, or a diuerse center: he cannot say that it hath a diuerse center, from the center of the Earth: First, because (as we haue de-

monstrated in our first part) the Earth and the Water haue but one center: and that the Water is concentricall with the Earth: Secondly from the second proposition or ground of his, out of *Aristotle*; if he meanes such a sphericity as hath the same center with the center of the Earth: I answer, first that he contradicts himselfe, because he giues an instance in small dropps cast on the ground, whose quantity being so small, and convexity sensible, can in no mans iudgement be concentrick to the Earth. Secondly, out of this ground that the Spheare of the water is concentrick to the Earth, he confutes himselfe; for according to the principles of *Geometry*, In a Spheare or circle, all the lines drawne from the center to the circumference must be æquall. Then must all places in the circumference or superficies of a sphericall body be of æquall height from the center, and by consequence the sea being such a Sphericall body, cannot haue that inæquality which *Keckerman* imagines it to haue: Wherefore some other demonstration must be sought for this conclusion. I will goe no further then that I haue spoken in the former chapter concerning the figure of the Water: Where I haue probabily shewed it to be conicall; and out of this may be easily gathered, how it may be higher then the land in some places, as of the middle of greater seas, where the head of the Cone is lifted higher; in other, lower; as in the narrow streits where the increase of the eminencie is also lesse. The grounds and principles of which we haue liued before.

I The sea in respect of the Earth is higher in one place then another.

Besides the naturall conformity of the Water to a conicall figure, (as we haue fore-shewed) whence one part of the superficies must be graunted to be higher then another we must needs in the sea acknowledge other accidentall causes which produce an inæquality in the parts of the sea: The chiefeest whereof are the Equality of inclination in all parts of the water to motion: And the inæquality of the channels and shores: whence it commeth to passe that the Water of the
 sea.

sea being every where of it selfe equally inclined to motion, is notwithstanding vn̄equally receiued into channels, so that in some place, hauing (as it were) a large dominion to invade, as in the maine Ocean, it falls lower and euener: In some other places as streites or narrow seas, the water hauing a large entrance from the Ocean, but little or no passage through it, must needs swell higher, and so one place by accident becomes higher or lower then another: Which farther to confirme diuerse instances may be alleaged out of moderne and ancient obseruations. For diuerse histories giue testimony that sundry Kings of *Egypt* by cutting the *Isthmus* or narrow neck of land lying betwixt the red sea & the *Mediterranean*, laboured to make *Africk* an *Iland* & open a passage siō one sea to the other: but afterwards they were perswaded to desist from their enterprise: Some say, because they saw the red sea to be higher then many parts of *Egypt*, and heerevpon feared a generall inundation of all *Egypt*, if the passage were broken open: Others haue deliuered that they feared, that if the passage from one vnto another were broke open, and the red sea having a vent that way, the red sea would become so shallow that men might wade ouer it, and so instead of making *Africk* an *Iland*, it would haue bin more ioyned to the Continent then before. Both opinions consent in this, that the waters of the red sea were by the perpendicular found higher then in the *Mediterranean*: Moreouer it is obserued that the sea on the west part of *America* commonly called *Mare Del Zur*, is much higher then the *Atlantick* Sea which bordereth on the Easterne part of it: which gaue way to the coniecture of some, that the *Isthmus* betwixt *Panama* and *Nombre De Dios* had bin long since cut through to haue made a passage into the *Pacifick* Sea, without sayling so farre about by the straits of *Magellane*; had not many inconveniences bin feared out of the inequality in the hight of the Water. The like inequality is obserued by *Versfegan* in the sea betwixt *England* and *France*: For according to his coniecture, *France* and *England* being one Continent heretofore, and ioined by a narrow neck of land, betwixt *Doner* and *Callais* the

the water on one side was higher then on the other: which he probably collects out of the sundry flats and shallows at this day appearing on the East side as well on the coasts of *England* as of *Flanders*, especially betweene *Dover* and *Calis*; called by some, our *Ladys Sands*, about three *English* miles in length: Out of which and sundry other probabilities, he labours to proue that all the *Low-countries* were heeretofore enveloped with the sea; till such time as the narrow land being either by *Nature* or *Art* cut through, and the Water allowed a free passage, it became *dry land*: but this point we shall discusse hereafter in place conuenient.

- 4 In the next place we are to consider the termination of the sea: The termination is the bounding of the sea within certaine limites.
- 5 The Limit is the margent or border of land wherein any sea is circumscribed.

The sea is bounded by the land, as the land by the sea: In respect of which termination some seas are called *Maine seas*, others *narrow*. The maine seas are foure; to wit, the *Atlantick* which taketh it's name from the mountaine *Atlas*, by which on the west side it passeth, and diuides *Europe* and *Africk* from *America*. 2 The *Ethiopian sea* running on the west side of *Ethiopia*. 3 The *Indian Sea* hauing the *East Indies* on the *North*. 4 *Mare Del Zur* or the *South sea*, situate on the *South side* of *America*: Which foure in respect of other may be called *Maine Oceans*. The lesser seas are either called *Creekes*, or *streites*: A *Creeke* is a place where the water (as it were) embosomes it selfe into the land, hauing an entrance large from the Ocean, and most commonly streynted inwardly, but no passage through: A *Creeke* againe may be divided into the *greater* or *lesser*: Vnder the former in a large sense may we comprehend the whole *Mediterranean sea*: for as much as the sea from the *Maine Atlantick Ocean*

by an inlet is ingulphed into it, but findes no passage out any other way, howsoever it invades a large territorie. The lesser Creekes are againe distinguished into the *Easterne* and *Westerne*: The chiefe Creekes found out towards the East are sixe in number. 1 *Sinus magnus* which lies betwixt *Mangus* and *India extra Gangem* reaching as farre as the region of *Chalcis*. 2 *Sinus Gangeticus* which is comprehended betwixt *Aurea Chersonesus*, and *India intra Gangem*. 3 *Sinus Canthi*, commonly called *Canthi-colpus*. 4 *Sinus Persicus*, bordering on *Persia*, and called by *Plutarch* the *Babylonian Sea*. 5 *Sinus Arabicus*, which is commonly called the *Red Sea*. 6 *Sinus Barbaricus*, which by *Pliny* is termed *Sinus Trogloditicus*, & at this day *Golpho de Melinde*. The Creeks lying Westwardly are chiefly these; First *Sinus Sarmaticus* lying towards the North, betweene *Denmarke* and *Norway*, which is diuided into *Sinus Finnicus* and *Bodicus*, which is called commonly the *Baltick Sea*. 2 *Sinus Granvicus* diuiding the *Muscovites* from the *Corely* Northward; it is commonly called the *White Sea*. 3 *Sinus Mexicanus* bordering on the city of *Mexico* in *America*, amongst these, some would number *Mare Pacificū*, or *Mare Del Zur*: but this we thought fitter to call a maine Sea, then a creeke, being extraordinarily large in quantity. A Strait is a narrow Sea betweene two Lands; of such Straits these were anciently knowne, to wit, 1 *Fretum Gaditanum*, or the *Straits of Gibraltar* of 7 Miles distance, diuiding *Spaine* from *Barbary*. 2 *Fretum Magellanicū*, found out by *Magellane*, which diuides *America Peruana* from the *Southerne land*. 3 *Fretum Anian*, situate betwixt the *western shore* of *America*, & the *Easterne borders of Tartary*. Besides these there haue bin discovered 3 more, (to wit) 1 *Fretum Davis*, found out by captain *Davis* in the year 1586, which lyes toward *Groenland*. 2 *Fretum Nasovicum*, or *Waygate*, neare *Nova Zembla*, discovered by the *Hollanders* in the year 1614. 3 *Fretum de Mayre* found out by *William Schouten* a *Bavarian*, taking his name from *Isaac le Mayre*, by whose aduice and perswasion he undertook his voyage. But some of these latter streits here mentioned, for ought I know, may better be reckoned amongst Creekes,

Creekes, forasmuch as they haue not as yet found any passage through, though with great losse and danger they haue often attempted the Discouery. Concerning the bounding of the Sea with the land, we will insert these Theoremes.

- I *The Water is so diuided from the dry-land, that the quantity of Water is greater in the South Hemisphære, of Land in the Northernne.*

That most part of the *dry* land is situate towards the *North*, will easily appeare by instance. For toward the *North* are placed the great Continents of *Europe*, *Asia*, almost all *Africa*, and the greatest part of *America*: But in the *South* Hemisphære, we find only a litle part of *Africa* and *America*, besides the *South Continent*, which we cannot imagine to be so great in quantity, as it is painted in our ordinary Mappes: forasmuch as all places at the first discouery are commonly described greater then they are. The reason I take to be this, that the first draught is alwayes confused & vnperfect, where in a Region discouers it selte vnto vs vnder a more simple figure, neglecting curiosities; but after a longer and more exact

search of any Region, will be found in many places ingulfed with diuers *Bayes*, and variously indented; in such sort, as the bound Line compassing it round, making an inordinate figure, and lesse regular, cannot contain so much land as first it might seeme to promise. Moreouer we may further obserue, that those places which in the first discouery haue bin taken for the main *Continent*, or at least for some greater part of Land, haue afterward vpon more curious examination, bin found clouen into many lesser *Ilands*: As in *America*, *Cuba* in the time of *Columbus*; and *California* of late, thought to be a part of the *Continent*, and so described almost in all our Mapps; yet since by a *Spanish Chart* taken by the *Hollanders*, discovered to be an *Iland*. The like instance we haue in *Terra del Fuogo*, which since the time of *Magellan*, was held a part of the *South Continent*, till *Schouten* by sailing round about

it, found it diuided from the main land by *fretum de Mayre*, carrying the name of the Master of the ship in his discoverie. Neither is it much to be doubted, but that in that large tract delineated out in the Globe for the *South-Indies*, are contained many Ilands, diuided one from the other by *streites* and *narrow Seas*, which must substract much from the quantity of the dry land: so that of necessity it must be granted, that the *Northerne* Hemisphere takes vp the greatest part of the dry land as the other of the Water. Wherefore that place of *Esdras* where he saith, *That Almighty God allotted six parts to the Earth, and the seaventh to the Water*; must either seeme improbable, or suffer another interpretation then that of the ancients. For out of credible coniecture drawne from the view of the face of the Terrestriall Globe, we shall hardly collect such a proportion. In this comparison of the *Northerne Hemisphere* with the *Southerne*, we shall find a kind of harmony betwixt the *Heavens* and the *Earth*: For, as Traveilers report, the *Northerne* parts abound with more starres, and of greater magnitude then the other toward the *South*; so the Terrestriall Spheare discovers vnto vs more continent, greater Ilands, and of more note, in the North then in the South.

2. *The whole Globe of the Earth is invironed round betwixt the East and the West with sea, dividing the North from the South.*

To proue this Theoreme we need goe no farther then the famous voyages of *Magellane*, *Drake*, *Candish*, and *Shonten*; Whereof the first attempted, the first passage through *Fretum Magollanicum*, and gaue it the name, though he could not out-lieue his intended journey. The two next followed the same way, and the last found out a new passage through *Fretum de Mayre*, as we haue formerly mentioned. Whence we may easily deduce this *Corollary*, that the *Southerne continent*, not yet perfectly discovered, is either *One*, or (which is most probable) *many Ilands*: forasmuch as by sailing round about it, they haue found it euerywhere compassed round with Sea. The like may be coniectured of the other parts of the world; on

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the northern side, wherof we shal speak in this next Theorem.

3. *It is probable that the Earth is compassed round with the water from North to South.*

I know nothing which hath exercised the wits and industrie of the Nauigatours of our age, more then the finding out of a passage Northward to *Cathay*, and so to the *East-Indies*, which controversie as yet remaines altogether unanswered, and awaites the happinesse of some new discourry. In which difficult passage, wherein many haue spent both their liues and hopes, it may seeme enough for me to goe with their Relations; suffering my conjecture to flye no farther then their sailes. The reasons which I meet within my slender reading, I will examine as I can, without partiality, and so leaue euery man to be his owne Iudge. First then we must consider that the voiage to the *Indies* must be effected by either of these two waies; to wit, *Northward*, or *Southward*. To beginne with the South, it must be performed two waies; either by some vnknowne passage through the *South-Continent* neare the *Antarctick Pole*, or neare the *Magellane Straits*. The former is most vncertaine, for want of discoueries in those vnknowne and remote parts: and if any such passage were found out, it were litle advantage to our Countrey-men, who haue already a shorter and nearer way: yet no instance can be giuen to the contrary, but that this part being cloven (as it seemes most probable) into many lesser lands, may admit of such a passage: But in such vncertainties it is as easy to deny as to affirme. The second *South passage* is found out by Nauigatours, which is either by the strait of *Magellan* it selfe, or else through the *Straights of Mayre* before-mentioned, which this Age of ours hath put out of doubt. The third passage is *South-east* by the *Cape of good hope*, knowne vnto our *East-Indian Merchants*, and therefore as a matter vnquestioned, needs no further examination. The onely matter which troubles men in this Age, is the finding out of a passage *Northward* to *Cathay*, either by the *North-east*, or *North-west*; wherein we will consider two

things: 1 Whether it be likely, that any such passage should be at all? 2. whether this passage should be performed by the North-East, or North-West. For the former many arguments are vrged which seeme to crosse this opinion, of a way to the *Indies* toward the *North parts*: For 1. The manifold attempts of the *English* and *Hollanders*, both towards the *North East* and *North West*, either altogether spent in paine, or failing of their ends, seemes to giue large testimonie, if not of absolute *impossibility*, yet at least of the vnlikelyhood of any such discovery as is hoped, For what cost or dangers would not almost all the Marriners of our *Northerne* world vndergoe, to find so neare a cut to their golden *Indies*? and if by chance many of them mistooke the right way, yet would it seeme improbable, that later Nauigatours corrected by the former errours, should not after so many trialls and attempts, at length hit the mark. This reason fauours of some *probability*: yet comparing this with diuers matters of the same kinde, would seeme to be of no great force. For the truth and right being onely one and the same, is opposed by infinite errours: so that it may seeme easier to commit a thousand errours, then once to hit the truth: Time and long triall beget many Inuentions, which afterward seeme most easy: insomuch that many men haue afterward laught at their owne mistakes. Moreouer, for ought I can find in the Relations of most mens discoueries, the passage which they sought was too farre Northward towards the Pole; where being infested with cold, Ice, and other inconveniences, they were enforced to returne thence againe, hauing seldome had any opportunity to winter in those parts for want of vituals, or extremity of cold. A second reason against this *North passage* may bee drawne from the innumerable sorts of beasts wherewith *America* is stored: for admitting this passage, we must needs grant *America* to be an Island. Now it is certaine that *Noah's Arke* was the store-house and Seminary, not only of mankinde, but of all other perfect liuing Creatures. Again, it is euident out of the *Holy Scriptures*, that the first

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Region whereon the Arke was deliuered of her burthen, was *Asia*. These grounds layed, I would demaund how such a multitude of beasts of al sorts, should be transported from *Asia* to *America*, being supposed to be an *Iland*, and, and euery-where diuided by the Sea from other parts of the Earth: could these silly creatures of their owne accord swimme from one shore to another? but alas! the Sea was too large, and these beasts too fearefull to adventure on such a voyage. And admit some by Nature had bin fitted to such an action, yet were it very strange to imagine the same effect of all, being of many kindes. What then? were they transported in ships? But Navigation in those daies being an Infant, vnfurnished of the *Chart* and *Compass*, durst not adventure into the *Ocean* so farre out of sight of land. But to giue the opposite part all reasonable advantage, admit the *Straites* diuiding *Asia* and *America* were very narrow, and within kenne; was it likely that from hence they could by shipp transport so many kindes of creatures? Could we beleue any man to be so mad, as to carry oner with him *Lyons*, *Beares*, *Tigers*, *Foxes*, and other innumerable sorts of rauinous and vnprofitable beasts, as pernicious to mankind, as other creatures seruing for his vse? if any were found so foolish or malicious, yet were it very vnlkely he should transport so many kinds. This argument seemes no more to concerne *America*, then most *Ilands* of the World, wherein we find diuers creatures, not only seruing for the vie of man, but many vnprofitable & hatefull to the Inhabitants: The meanes of this transportation is very difficult to finde. *St Augustine* with some other Diuines haue bin driuen to a supernaturall cause, as if Almighty God should performe this matter by the ministry of Angels, which answer we dare not vtterly reiect, being supported by the authority of so great a Pillar of the Church: yet I cannot so easily imagine, that God who vsed naturall meanes for the preservation of all liuing creature: in the Arke, should haue recourse to a supernaturall power in the propagation of these creatures on the face of the Earth: wherefore to me the reason would seeme better answered out of our ground which we shall proue hereafter:

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That Ilands were not from the first Creation, but afterward broken from the maine Continent by the violence of the Water: Hence it might come to passe, that such beasts as were in the parts of the Earth so broken off, haue since there continued by continuall propagation vntill this day; I mean of ravenous and hurtfull beasts: because of the others lesse doubt can be made, but that they might be conuayed from one Country into another by shipping, to serve the necessity of mankind. Here we see that no argument as yet hath bin vrged so strong against the *North passage*, but may with reasonable probability be answered. It remaines in the second place that we descend somewhat to particulars, to inquire whether this be to be effected either toward the *Northeast* or the *North-west*: The *Northeast passage* hath heretofore bin attempted by many of our *English* Navigatours, but with vnhappy successe: yet were not these voyages altogether fruitlesse; forasmuch as by this meanes, a way was found out to *Russia*, whence began the first trade betweene ours and the *Russian* Merchants: But that litle hope can hence arise, sundry reasons may be alleaged, the chiefe whereof are these; 1 The dangerous tending of the *Scythick Cape*, set by *Ortelius* vnder 80 degrees Northward, together with the perillous sailing in those Northerne Seas alwayes pestred with Ice and Snow, seconded by diuerse *Bays* or *shelues*, *mists*, *fogges*, long and darksome *nights*, most aduerse to any happy Navigation. 2 The obseruation of the Water, which is more shallow towards the *East*, which giues smal hope of a thorough passage, because all *Seas* are fed with waters, and for the most part are obserued to be more shallow towards the shore then in the midule: But where in sayling forward, any Sea is found to decrease in depth; it is a likely argument, that it is rather a *Creeke*, *Bay*, or *Riuer*, then a *Straire*; Notwithstanding these reasons, some haue heretofore gone about to proue a passage by the *Northeast* to *Cathay*; of which opinion was *Antony Jenkinson*, whose reasons be well answered by *Sr Humphrey Gilbert*, which I will briefly touch, adding some things of mine own, as I find occasion. The first reason was drawne from

from a Relation of a *Tartarian*, who reported that in hunting the *Morse* he sailed very far towards the *South-east*, wherein he found no end; which might giue a likely coniecture, that it was a passage throughout. But to this we may easily answer, that the *Tartarians* are a barbarous Nation, altogether ignorant of Navigation, which neither know the vse of the *Charte*, *Compass*, or *Celestiall Observations*; and therefore in a wide Sea know not how to distinguish the *North-east* from the *South-east*: Besides, the curious search of this long passage must depend on better discoverers then a poore Fisherman, who seldome dares adventure himselfe out of sight of land; besides, the Fisherman iudging by sight, could not see about a kenne at sea, which will proue nothing in regard of so long a distance. The second Reason vrged by Mr *Jenkinson*, was this; that there was an *Unicorne's* horne found vpon the coast of *Tartaria*, which could not come (saith he) by any other meanes then with the tides in some streight in the *North-east* in the frozen Sea, there being no *Unicorne* in all *Asia*, sauing in *India* and *Cataia*. To this reason I may answer with *S^t Humphrey Gilbert* many waies; 1 Wee may well doubt whether the *Tartarians* know a true *Unicorne's* horne, or no: 2 It is not credible, that it could be driuen so farre by the Tide, being of such a Nature that it cannot swimme. 3 The Tides running to and fro, would haue driuen it as farre backe with the *Ebbe*, as it brought it forward with the *Floud*. 4 The Horne which was cast on this coast, might be the Horne of an *Asinus Indicus*, which hath but one Horne like an *Unicorne* in his fore-head, whereof there is great plenty in all the *North* parts, as in *Lappia*, *Norvegia*, *Finmarke*, as *Zeigler* testifies in his History of *Scandia*. 5 Lastly, there is a fish which hath a Horne in his fore-head, called the *Sea Unicorne*, whereof *Martin Frobisher* found one on the coast of *Newfound-land*, and gaue it to *Queene Elizabeth*, which was said to be put into her Wardrobes. But whether it be the same which is at this day to be seene at *Windsor Castle*, I cannot tell. The third and strongest reason which was vrged for the *North-east* passage was this: That there was a continuall current through the

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Frozen Sea, of such swiftnesse, that if any thing were throwne into the water, it would presently be carried out of sight. To this we may easily answer, that this strong current is not maintained by any Tide coming from another Sea, but by diuerse great Riuers falling into this *streight*. In like sort we find a strong current from *Mæotis Palus*, by *Pontus Euxinus*, *Sinus Bosphorus*, and along all the coast of *Græcia* (as *Contarenius* and diuerse others affirme out of their own experience) and yet the Sea lyeth not open to any other Sea, but is maintained by *Tanaïs* and diuerse other riuers: so in this *North-east* part may this current of water be maintained by the Riuers *Dniina*, *Ob*, and many others which continually fall into it.

Hitherto haue we treated of other passages, either effected or attempted to *Cathay* and the *East Indies*. The last and most desired and sought in our time, is that by the *North-west*. This way hath bin often attempted, as by *Cabot*, *Danis*, *Frobisher*, *Hudson*, *S^r Thomas Button* and others, but as yet not found out. Neither hath it more troubled the industry of *Marriners*, then the wit of *Schollers*; which we shall find by discourses written of that subiect. The absolute decision of this contro- versie we must leaue to Time: onely such probabilities as I chance to meet with, I will faithfully set down, to giue encouragement to their deseruing labors, who shall farther attempt the search and full discouery of this *North-west* passage. The Reasons I find vrged, I may well reduce to three Heads: The first is drawne from the testimonies and opinions of ancient Writers: The second from the Relations and discoueries of later Navigatours, from the time of *Henry the seuenth*, till our age: The third and last from the last and newest adventures of men of our time; either lately dead or liuing. To begin with the first, we shall from the testimony of *Plato* in *Ti- mæo*, as also in his Dialogue called *Critias*, draw a probable argument: for there he makes relation of an incomparable great Iland, named *Atlantis*, of larger extent then *Europe* and *Asia*, which was situate Westward from the streights of *Gibraltar*, and navigable round about. The Princes of this Iland

(according to *Plato's* report) heretofore extended their government ouer a great part of *Europe* and *Africa*. To second which opinion of *Plato*, we shall read in *Marinus Siculus* his History of *Spaine*, that in the *American* golden Mines, discovered by *Columbus*, there haue bin found certain pieces of Coine, ingrauen with the Name and Image of *Augustus Caesar*, which were afterward sent to the *Pope* by *Iohn Rufus*, *Archbishop* of *Consentium*: whence a probable coniecture seemes to be grounded, that *America* in those dayes was both p^opled and discovered. Now it appears again not only by *Plato*, but also by the opinion of *Marsilius Ficinus*, *Crantor*, *Proclus*, and *Philo Indeus* is witnessed in their learned Commentaries on *Plato*, that this Iland called *Atlantis*, some 600 yeares before *Plato's* time, suffred an extraordinary inundation, & was swallowed vp by water: other like ex^amples whereof we shall produce many, hereafter in place convenient: admitting these testimonies of antiquity, whereof we ought to cherish a reverend esteem, these coniectaries will seeme to offer themselves by way of necessary consequence: 1 That this Iland *Atlantis* was the same which afterward from *Americus Vesputius* got the name *America*: because we find no Iland in the *Atlanticke* Ocean which comes neare that greatnes and quantity assigned by *Plato*: 2 That this *Atlantis* or *America*, in those dayes at least was an Iland, because they reported it to be Navigable round about. 3 It must stand with great reason & probability, that this land being an Iland before *Plato's* time, should be so still, if at least it come not neare to the nature of an Iland at this day, then before: For either this Relation of the overflowing of this land is true or false: If at all it deserues credit, more reason is, that it should be Nauigable round about then before: in somuch that the Water in this manner swelling high, would sooner fret through and cause a passage, then make a stoppage. 4 This passage must of necessity be toward the *North-West* where *America* is diuided from *Asia* by the streites of *Anian*, which opinion seemes better warranted, for asmuch as we find it seconded by the descriptions of many Geographers of great name

name and authority, as *Gemma Frisius*, *Münster*, *Appian*, *Hunterus*, *Guicciardine*, *Michael Trameſinus*, *Franciſcus Demongentius*, *Bernardus Puteanus*, *Andreas Vavaſor*, *Tramontanus*, *Peter Martyr*, and *Ortelius* in his generall Mappe: Who all haue deſcrib'd *America* as an exact *Iland*, ſetting downe all the coaſts and countreyes on the North-weſt ſea of *America* from *Hoche-laga* as farre as *Cape Paremantia*; all theſe learned men hauing with one voice deſcribed or reported *America* for an *Iland*; He ſhould ſhew but a ſlender eſteem of antiquity, or ſauour of too much ſelfe-conceits, who ſhould offer to contradict. This firſt Argument I confeſſe ſpunne out into ſo many circumſtances, ſeemes at firſt ſight to carry a great ſhew of truth; but vpon ſound examination will be found very defectiue, and vncertaine, carrying more probability in the concluſion, then the premiſſes dare to iuſtify: How many *Paralogiſmes* and vncertaine grounds are involved in this reaſon, let my ingenious reader iudge; 1 whether *Plato's* report of this *Atlantis* were a true Relation grounded on experience and obſervation, or a pleaſant *Fiction* deriued from the Poets of that time, wherewith the *Grecian Learning* was much infected; 2 How comes it to be thought probable that *Plato* in thoſe dayes ſhould be ſo exact in delineating out the boundes of this *New-world*, who was ſo ignorant in the old, as to thinke *Europe* and *Aſia* to be inferiour in greatneſſe to *America*, which notwithstanding he thought to be an *Iland*. 3: How ſhould ſo famous a King as *Atlas*, ſtretching his Monarchie (as the Authors of this reaſon report) from *America* to a great part of *Europe*, and *Africk*, in that vaſt gulph of time, ſlurpe away with ſo ſlight a mention: That there was ſuch a Prince as *Atlas*, I make no quaſtion; vpon whoſe fame and greatneſſe the Poets grounded that fiction of raiſing vp the vault of heauen with his ſhoulders: But whether this *Atlas* ever ſaw *America*, my reader muſt giue me leaue to make a doubt; The Ignorance of Nauigation in thoſe times, wherein occaſion had not brought to light the *chart & compaſſe*, together with the huge vaſtneſſe of the *Atlantick Ocean*, will ſpeake my Apologie. 4 The finding of coine graued with

with the Image and inscription of *Augustus Caesar* in the *American mines*, seemes to me more ridiculous then all the rest: We find the acts and conquests of *Caesar* and *Pompey* in *Europe* and *Asia* and some parts of *Africk* particularly set downe by the graue writers of that time: We find *Augustus Caesar*, for some petty conquests against barbarous people, emblesoned by the *Poets* of that time to the highest pitch of their invention: we may obserue the age wherein *Augustus* lived to be the florish and pride of all the *Romane* learning: and himselve the Idoll and subiect of most of their poeticall flatteries; having the happinesse to be inuested in the empire, in such a time wherein the *Roman* Monarchie hauing bin too much wounded with a ciuill dissention, was willing to admire her worst Physitian: And can any man be so senselesse to imagine that the discouery of the goldē world should passe away clouded in such a flattering age, without any mention? could not so much as the name be registred to teach posterity the way to so rich an Empire? For my owne part I can ascribe this, (if the *Historie* deserue credit) to nothing else but the pride and imposture of the *Spaniards*, whom we obserue in all relations to be a most ingratefull Nation, who admiring nothing but their owne greatnesse, haue requited their best deserving benefactors with disgrace, and obloquie; struiuing to raze out their names and memory to whom they owe the greatest glorie. *Columbus* was a *Florentine* and no *Spaniard*, and therefore must not deserue so much of *Spaine* as his *golden Indyes*: otherwise *Augustus Caesars* image had bin better lost then found; and the Bishop receiued small thanks for his *Parasick* presentation. 5: That *America* should euer suffer such a deluge as to be lost for so large a time, will sooner be admitted as a pleasant discourse in table talke, then purchase credit as a likely *History*: it seemeth to be doubted by *Mer-cator* a Great *Geographer* of latter times, inferiour to none before named, whether euer this tract of land were overwhelmed with Waters in the generall deluge; which he was induced to belecue out of the disparity of the Soile, Herbes, *Feasts*, and *Inhabitants* with ours in *Europe* and other parts of the world;

world; This opinion I hold not sound in Divinity; yet seems it backt with more strength of humane reason, then *Plato's* fable of this imaginary *Atlantick Island*: Much more could I speake of the vncertainty of this first argument, were I not afraid to tire my Reader too much: But this *Northwest-passage* is a long voyage, and hath bin for a long time sought, and therefore I hope ingenious men will pardon my long discourse.

2 The second reason is taken from a Relation reported by *Gemma Frisius* of three Brothers, who in ancient time passed through this strait into *America*: which accident gaue it the name of *Pretum Trium Fratrum*, by which appellation it is knowne at this day. This argument I take to be more weake then the other, as depending on vncertaine report, indebted I know not to what approved *History*: But where *History* is vncertaine, reasonable coniecture must challenge precedency: I will heere by way of doubt aske these few questions; whether these three Brothers before mentioned passed through this strait or not? If not, no good Argument can hence be grounded of such a passage: or if they passed through, I demaund whether they returned to their Country or not, to make a relation? If they returned not, how could such a report with probability be brought home vnto vs? 3 If they returned home, how could such a memorable Action be forgotten, and not committed to any certain *History*? especially in such a *Monkish* age, wherein out of ignorance and want of experience, the most petty Inventions were admired for great matters: The reason as yet makes me to suspend my iudgment of Decision, till I find better.

3 The third reason drawne from antiquity, best vrged and husbanded by *S^t Humfray Gilbert* for this *North west* passage, depends on a certaine Relation of *Indians* in ancient time, cast by tempest on the coasts of *Germany*. *Pliny* relates out of a report of *Cornelius Nepos*, who wrote 57 yeares before *CHRIST*, that certaine *Indians* were inforced by violence of tempest vpon the *Germane* coasts, which were afterward presented by the King of *Suevia*, to *Quintus Metellus*

Celer,

Celer, then *Proconsul* of *France*, whereupon *Pliny* insertes in his 2^d Booke 65 Chapter, that it is no great wonder, though there be a sea *North*, where there is so much moisture. To confirme this opinion of *Pliny*, and report of *Cornelius Nepos*, they produce the testimony of the excellent Geographer *Dominicus Marinus Niger*, who sheweth how many wayes the *Indian Sea* extendeth it selfe, reciting the same report of certaine *Indians* that were carried by tempest through the *North-seas* from *India*, vpon the Borders of *Germany*, as they were following their Trade of Merchandize: The argument grounded vpon these Testimonies will stand thus: These fore-named *Indians* arriuing on the coasts of *Germany*, must come of necessity either by the *South-east*, *South-west*; *North-east*, or *North-west*. The three other coasts seeme altogether improbable, and therefore this opinion of the *North-west* seemes more worthy credit; first, they came not by the *South-east*; because the roughnesse of the Seas, occasioned by stormie windes, and strange currents in those places about *Cape bona Speranza*, seconded by the smalnesse of their *Canoas*, wherein the *Indians* vially travailed, seeme to stand against such a long voyage: 2 They could not well come along by the shore of *Africk*, and so passe into *Europe*, because the windes doe there commonly blow *Easterly* off from the shore; so that the current driuing that way would sooner haue carried them *Westerly* vpon some part of *America*, where they should by all likely coniecture, haue perished in that great *Atlantick Sea*, either in that huge and great *Atlantick Sea* either by shipwracke, or want of provision in so small a vessell. 3 If they had overcome all these dangers which wise men would hardly take vp vpon trust: It seemes hard they should not haue first touched vpon the coasts of the *Azores*, *Portugall*, *Spain*, *England*, or *Ireland*, before they should arriue at the coasts of *Germany*. 4 For the reason before-named they could not come from the *South-west*, because the current which commeth from the *East*, striketh with such violence on the straites of *Magellane*, running with such swiftnesse into the *South-sea*, or *Mare del Zur*, that a shippe without great burden

cannot

cannot without much difficulty arrive at our *Westerne Ocean* through that narrow sea: What then shall we imagine of an *Indian Canoe* managed by such unskillfull mariners? 5. To prove these men to be true *Indians*, and neither *Africans* nor *Americans*, seems to be warranted; because the Inhabitants of *Africa* & *America* neither had, nor scarce know other kinde of Boates then such as beare neither *mastes*, nor *sails*; but such as are only carried along by the shores: except of latter times such as have bin instructed by the *Turkes* on the coasts of *Barbarie*, or by the *Spaniards* in *America*: This argument I confesse is wittily spunne out by my renowned country-man *S^r Humphry Gilbert*, whose ability seems to have made a harvest out of the stubble. Nevertheless in my conceipt it promisseth in the conclusion more then the premises can well warrant: For first it seems not to me a matter so cleare out of question whether these ship-wracked people cast in vpon the coasts of *Germany* were true *Indians*, for not; because so farre as my coniecture leadeth me, being grounded on *Historie*, the name of *Indians* out of the ignorance of those times hath bin giuen by the *Romans* to many other forraigne Nations farre distant; especially to the *Ethiopians* in *Africk*, which beside the testimony of diverse ancient Historians, too tedious to relate, may seeme probable out of that end of a verse of *Horace*; *Vltra Garamantas & Indos*: where for ioyning together two Nations so seperat in place, the former being in *Africk* the other almost in the farthest verge of *Asia*, he seemed as ignorant of the distance, as the people. 2 How should these *Westerne* inhabitants know these men to be true *Indians*, whose condition, place and language they neuer vnderstood? 3 Why might not these men come from some of the *Ilands* in the *Atlantick Ocean*? 4 The reason against it, drawn from the current striking with such force on the *streits* of *Magellane*, is contradicted by the experience of latter Navigators; much more I could speake of this reason; but that I hold it better to cherish a hope of such a passage, then by excepting against these ancient arguments to discourage moderne industrie.

Other probabilities may seeme to be drawne from the discovery,


coveries of later Navigatours since the raigne of *Henry* the seventh, vnder whose protection *Sebastian Cabot* vndertook the discoverie of the *North-west* coasts: In which he prevailed as much as the *Alchymistes*, who in seeking out the *Philosophers* stone haue often mist of their aime: yet by this meanes inuented many rare and excellent secrets, of vse, and admiration. That *Cabot* the same yeare discovered as much of the *Northerne* parts of *America* as *Columbus* of the *Southerne*, cut of my small reading seemes to me no great question, whence I cannot imagine that King *Philip* of *Spain* can in this *Newfound-world* challenge a greater interest then King *Charles* of great *Brittain*; a Prince of those incôparable virtues, which may be thought worthier to own, then the other's to pretend to so great a Soueraignty: For the latter voyages & discoueries of *Davis* and *Frobisher* (for ought I see) promise scarce so much as *Hope*, which oftentimes flatters and deceiues men with her best countenance. But if we take vp wares vpon trust, some will tell vs of a *Portugall*, who made a voyage through this *Streite Northward*, calling a Promontory within the same after his name *Promontorium Corterialis*; of *Scolmus* a Dane, who passed a great part thereof: but the most probable in my coniecture, is that which *S^r Humfrey Gilbert* reports of one *Saluaterra* a Gentleman of *Victoria* in *Spaine*, who was said to haue passed by chance out of the *West Indies* into *Ireland*, in the yeare of our Lord 1568, who constantly averred the *North-west* passage from vs to *Cathay* to be thought navigable, and farther related in the presence of *S^r Henry Sidney*, then Lord Deputy of *Ireland* (*S^r Humfrey Gilbert* being then present) that a Frier of *Mexico* called *Andrew Vrdanetta*, more then eight yeares before his arriuall, told him that they came from *Mare Del Zur*, through this *Northwest* straite into *Germany*, and shewed *Saluaterra* (being with him at that time in *Mexico*) a *Sea-chart*, made out of his owne obseruation in that voyage, wherein such a passage was expressed, agreeing with *Ortelius* his *Mappe*: moreouer this Frier told the King of *Portugall* in his returne by that country home-ward, that hauing found such a *Northwest* passage, he

meant shortly to make the same publicke; but the King earnestly intreated him not to discover this secret to any Nation; for that (said he) if England had knowledge and experience of it, it would greatly hinder the King of Spaine and me. This relation I could willingly credit from the mouth of any other man then a *Frier*; of whose palpable lyes, and fabulous inventions in their flattering letters to the *Pope*, from both the *Indies*, we haue sufficient experience. Neuerthelesse that future ages might not despaire of so worthy an attempt as the discovery of this passage, it hath pleased God to stirre vp the Spirits and Industry of two later Navigatours, *Hudson*, and *S^t Thomas Button*, who haue reuiued the forlorne hopes of the former. For the particulars of whose discoveries I know not better where to referre my Reader, then to a curious Mappe not long since set out by our worthy and learned Professor *Mr Briggs*: the arguments I collect from thence are these, expressed in his own words; 1 In the bottome of *Hudson's Bay*, where he wintred, the hight of the Tide was but two foot, whereas by the nearenesse of the South sea in *Port Nelson*, it was constantly 15 foot or more. 2 Moreover in *Port Nelson*, where *S^t Thomas Button* did winter, in 57 degrees he found the Tide constantly, every twelue houres, to rise 15 foot or more: and that a West wind made the *Nepe Tides* equal with the *Spring Tides*; and the Summer following, about the latitude of 60 degrees he found a strong race of a Tide running sometimes Eastward, sometimes Westward. 3 To shew the land toward the *South sea*, through which we seeke to open this passage, not to be so far off as our ordinary Charts seeme to pretend, may be probably auerred, in that *California* heretofore supposed to be a part of the *Western Continent*, is since by a *Spanish* Chart taken by the *Hollanders*, found to be a great *Island*; the length of the West shore being about 500 leagues from *Cape Mendocin* to the South Cape thereof, called *Cape S^t Lucas*; which may appeare both by the *Spanish* Charts, and by the report of *Francis Gaule*, whereas in the ordinary Charts it is expressed to be 1700 leagues. These Arguments, I confesse, haue swayed my opinion, but not as yet ab-

solutely freed me from doubt. Three *Queries* I must leaue for the learned to consider, and for the time to decide; 1 whether this relation of Mariners concerning the Bay of *S^t Thomas Button* and *Hudson* be true or no? no man will (I suppose) censure me as vnmanly for asking such a question, considering how much many Navigatours, either by their mistakes or their industrious falsities haue deceiued mens credulities; the one is incident to mankind, which out of vncertain observations, or vnecessary deductions, from thence often drawes an ill consequence; The other, the ordinary policy of discoverers, who lest their Trauailes might bee thought fruitlesse, would at least promise hope in the reversion. How many relations haue bin corrected by experience of later Navigatours, euery one may iudge. 2 Whether this strong Tide in *Hudsons Bay* coming from the *West*, were from the *South-Sea*, or from the *North*, betwixt the Continent and diuerse Ilands by an Inlet, is not a matter as yet clearly out of doubt. *Terra Del Fuogo* was heretofore supposed to be a Continent, till *Schouten* in his discovery found it to be an *Iland*, and a large Sea beyond it toward the *South*. Likewise *New-found-land* in all our former Mappes and Globes, expressed as a part of the *Maine of America*, is by later experience found to be an *Iland*; and why may not this happen in the other, that at the entrance into *Hudsons Bay*, the land on the right hand should be clouen into many *Ilands*; betwixt which the waters issuing, should be turned in such sort, as it might seeme to proceede from the *West*: sith the Tides taking their beginning from the *Maine Sea*, and continued through some Straite, commonly followe the crooked windings of the Channell. 3 That *California* is an *Iland*, it may (for ought I know) be well warranted: But the euidence drawne from the *Spanish Chart*, seemes rather to cherish hope, then perswade consent. In this which I haue spoken of these worthy mens coniectures, I haue rather expressed my doubts, then my opinion; esteeming notwithstanding that doubt almost an *Herese*, which should discourage any generous and deseruing spirit from a farther attempt of this *North-west Passage*.

CHAP. VIII.

Of Sea-Trafficke and Merchandize.

I  F the Internall Affections of the Sea we haue spoken: It remaines now that we treat of the *Externall*: By the Externall I vnderstand that which belongs to *Sea-Trafficke*, or *Navigation*.

2 *Sea-Trafficke* is a passage by Sea from one Countrey to another.

It is not my purpose in this place exactly to set downe the Art of *Navigation*, being a matter requiring a speciall Treatise of it selfe; yet because shipping and Navigation, as *Externall* or *diacent Accidents*, belong to the Sea as the proper subiect; I could not altogether slip them ouer without some mention: In handling of which matter I onely propose to my selfe two things: first, the *Author* and efficient causes of *Sea-voyages* or *Navigation*; Secondly, the *End* and *Vses* thereof: both which we will knit vp in these two generall Theoremes.

I *Navigation* first taught by Almighty God, was afterward seconded by the industry of famous Men in all ages.

The first invention of this excellent art we can ascribe to no other author then God himself, who first taught the *Hebreus* his chosen people, and not the *Egyptians* and *Phenicians*, as some haue falsly imagined: For we read in *Genesis* that *Noah*

according to God's precept, made an *Arke* for the preservation of himselfe and other living creatures from the deluge: before which we cannot learne that there was extant any skill of *Navigation*: Of which we haue many reasons and conjectures giuen by ancient writers. 1 Because in those times there was greater need of *Cities* then *ships*; because citties are not made for ships, but rather ships for the vse of citties. 2 Small or little commodity could in those times be reaped from other countries, lying as yet rude and vnpossessed without Inhabitants. 3 Some would haue this to be a reason why God revealed not this art to the *old worldings*; because being ready to perish in the flood, no man might haue meanes to escape or saue himselfe, which without doubt they would haue attempted, had the art of Navigation bin known amongst them. Whence it is a probable conjecture, that this knowledge of Navigation was discovered first to *Noah* at the time of the *Deluge*: whose *Arke* resting afterwards on the meuntaines of *Ararat*, gaue a president to other Nations neere bordering, in what manner ships were to be framed. Whence it came to passe that the first to whom this skill was derived next to the *Hebrewes* were the *Tyrians* and *Phenicians*, Nations as well for the commodity of the place as Inclination to such businesse more accommodated to Navigation: For *Tyre* was a chiefe *Mart-towne* of *Phenicia* bordering vpon the sea. Which knowledge being derived from them to other nations gaue occasion to *Strabo* and *Strabo* to conjecture that they were the first Inventours of it, being not able through the want of holy writ to ascend higher. From the *Phenicians* was this knowledg derived to the *Egyptians*, as *Pliny* reports in his 7 booke and 56 chapter, when as yet this art was but rude and altogether vnpolished, as may appeare by the same *Pliny*; who testifies that they then began to saile in a certaine vessell called *Ratis*: which word how soeuer it now be taken generally for any ship, was originally interpreted to be made of *Beams* ioyned together; In which kind of ship they are reported to haue passed the *Mediterranean* sea, but especially the *Red-sea*, being set out by

King *Erithra*. Then came this art from the *Egyptians* to the *Gracians* (according to *Pliny* by *Danans*) who perfected this science, and made a ship in a more exact forme then he had learned amongst the *Phenicians*: whence *Danans* was celebrated the first Author of this inuention: it being a common error amongst all Natiōs to ascribe the first inuention to him, who was the first discoverer of it to them, being able to deriue it no further: Yet the *Gracians* being very full of fabulous inuentions haue found out other Authors of this art; for *Strabo* in his 10 booke, giues it to *Minos*: others, as *Diodorus Siculus* in his 6 booke, to *Neptune*; who is of opinion, that for this cause he was afterward translated into the number of the Gods. But this is certain that amongst all the *Gracians* the *Cretenians* were the first that excelled in this faculty. Whence grew that Proverbe: *Cretensis nescit Palagus*: as who should say nothing could be imagined more absurd and ridiculous then that a man should be borne in *Creet* and haue no skill in Nauigation: Others ascribe the first knowledge of making ships to *Dadalus*, a rare workman in mechanical occupations: From the *Gracians* afterwards was this trade communicated to the *Italians*, amongst whom the *Geneuensians* and *Venetians* most excelled. Of the *Venetians* skill in this matter, we read no other argument then their great riches and magnificent power, especially by the sea, which hath continued vnto this day: whereof no other cause can be thought on, next vnto Gods prouidence, then their industrie in *Sea-voyages*. After these arose the *Portugalls* who vnder the conduct and direction of *Columbus* an Italian, discovered *America* called the new-world, and gaue example and excitement to many other Nations to adventure farther. Amongst which (by the testimony of our-landish people) no Nation hath waded farther then the *English*, who vnder *Drake* and *Candish* haue compassed about the world and left an aternall Trophie of their immortall fame vnto posterity. Yet can we not heere defraud the *Low-country* men of their due commendation, especially the *Hollanders*, *Flemmings*, and *Selanders*; who by their riches acquired by nauigation and extraordinary power at Sea, haue kept in despiht of the

the vsurping *Spaniard* these Provinces, farre richer then at the beginning of their warres, and deserued that saying which was giuen to one of the *Gracian* cities, by the Oracle; *That it was guarded not with stones, but with wooden walls.* Thus much may suffice for the Authors and first Inventours of Navigation. We are now to speake something of the ends & vses of it, which may in generall be referred either to *profit* or *pleasure*: Both which are againe spread into many Branches; the most of which we shall comprize in this following Theoreme.

2 *Navigation is very necessary as well for the increase of Knowledge as Riches.*

Necessity is vsually taken two wayes; either for an *absolute* need, without the which a thing cannot be: or *Comparatively* for a conueniency, without the which a thing cannot well be: In both senses I may call Navigation necessary for a mans life: for to deferre the later, whereof lesse doubt is made; it is certaine that many places are so poore, barren, and indigent of all succour and reliefe, that they cannot maintaine a populous Nation without forraigne commerce and traffick; especially in these dayes, where the multitude of men is increased to so great abundance: for the later, many arguments may be produced to proue the conueniency of Navigation, which no man of any iudicious insight can deny to be most strong and forcible. The first argument may be drawne from the Authors and Inventours of it, whereof we haue spoken in the former proposition: for first (as wee haue shewed) it was prescribed by God himselfe, who neuer taught mankind any thing idle or vnecessary. It was embraced and cherished by many Nations euen till this day, which no doubt had long since bin lost; had not vse and profit seconded the Invention. Neither is it probable that Almighty God should create that vaste Masse of Water, that it should be an Element for fishes to liue onely, or that (as some guesse) it should somewhat mitigate the extremity and drouth of the *Sunne's* heat: But that men should by this meanes haue an ea-

sie and ready way to communicate and traffique one with the other ; which may appeare aswell by many *Testimonies* out of the sacred *Scripture*, namely *Psal. 104. ver. 25. Esa. 26. ver. 1. 2.* as also by the example of King *Salomon*, the wisest of all Kings, who by this meanes got great store of gold from *Ophir* to build the Temple, as will appeare in *1 Kings* and the 9 Chapter. The second reason therefore may be drawne from the exercise of *Merchandize*, and transportation of commodities, which cannot be administred without *Sea-voyages*: first because greater store of Merchandize may be carried in a *ship* then in a *Cart, Waggon*, or any other Instrument ordinarily in vse. Secondly, because in ships greater variety of wares may be brought from diuerse places, to which a Waggon cannot without great difficulty approach, or not at all. Thirdly, because wares and such commodities cannot so quickly be conuaied in the land from places farre distant, as on the sea: nor with so little cost and charges. The commodities conuaied from one country to another are chiefly three; *stufes* and other matters necessary for apparell: *virtualls* and food; *Physicall Druggs*: all which no man will deny to be most profitable for the vse of mankind. Moreouer it is not to be imagined that nature produceth such commodities only for the priuate behoof of some one country wherein they grow: First because such commodities in some countries are found in such abundance, that the same place seemes not to need them: And nature were vaine, if the vse were not required. *India mittit Ebur, molles sua thura Saba.* Secondly, because other Nations altogether want such things which abound in other countries: without the which notwithstanding they cannot well liue. A fourth reason may be drawne from the promotion of *Religion & sciences*, which cannot well be atchieued without *Sea-voyages* or Navigation. For the former we need goe no farther then the holy *Scripture* which giues large testimony of such voyages: In the old *Testament* aswell as in the new, we haue recommended to all posterity the industrie of the *Queen of Saba*, who is said to haue come from the vttermost parts of the Earth to heare the wisdom of *Solomon*: And how should the


the Gospel of CHRIST haue bin divulged to diuerſe Nations, had not the Apoſtles diſperſed themſelues, and paſſed the Sea in ſhips, to conuay their ſacred meſſage to diuerſe Nations and Kingdomes? neither is it leſſe euident in the propagation of *Learning* and humane *Sciences*: Firſt, out of the example of many & famous worthy *Philophers*, who traueiled far to conuerſe with learned men of other Nations, to enrich their mindes with knowledge. Secondly, out of the firſt propagation of *Learning* into our parts; which we ſhall finde (as it were) foot by foot to follow Navigation. Hence we ſee that from the *Hebrewes* and *Chaldees* it was deriued to the *Tyrrians*; from them to the *Egyptians*; ſo to the *Romanes*, and thence to moſt parts of *Europe*. A fourth reaſon may be taken from the neceſſity of transporting *Colonies* into forraign countreyes: for as after the vniuerſal *Deluge* of the world, the people dayly encreasing, were enforced in tract of time to diſperſe themſelues into diuerſe Countreyes: ſo euery Country left to it ſelfe, and not much moleſted with famine, or deuoured by warres, will at length grow too populous, vnable to ſuſtaine it's owne weight, and relieue it's own Inhabitants. Whence it hath bin a policy practiſed by moſt Kings & States in ſuch caſes, to make forraigne expeditions, and ſend forth Colonies into other Countreyes leſſe peopled, to diſburden their owne of ſuch encombrances: as we ſee the Kings of *Spaine* to haue ſent many iuto the *Weſt Indies*; and we at this day diſcharge many *Idlers* into *Virginia* and the *Barmudas*. Here alſo is the Art of Navigation uſefull, without which, the Seas could not be paſſed, nor forraigne Countreyes knowne. Fiſtly, Navigation ſeemes to be of greater importance for the defence of a Country againſt forraigne Nations; becauſe *Sea-fights* are leſſe dangerous and inconvenient to the Land, then *Land-fights*. All theſe arguments haue their force and life to proue the profit of this excellent Science. Many arguments may be drawne to proue the uſe of it for *pleaſure* and delectation; which being well vſed, hath his place amongſt other of *God's* eſpeciall bleſſings. This delight will firſt ſhew it ſelfe in the mutuall commerce and ſociety with other Nations: Sith a

man (as *Aristotle* affirms) is by nature inclined to mutual society, and cannot reape greater pleasure then in such conjunction: And as one Man with another findes solace; so one Nation with another: especially in the variety of sundry manners, customs, rites, and dispositions. Secondly, in the contemplation of wise Nature, who hath endowed diuers countieys with diuers Minerals, Plants, Beasts, and such commodities; then which variety nothing can be more delectable to an ingenious vnderstanding. To all which we may add as a Corollary, the Honour which hath bin giuen to Navigation by Princes and States, as well of former as later yeares. In ancient times we read that *Ptolomy Philadelphus*, that learned King of *Egypt*, who furnished himselfe with so rich a Library 277 yeares before *CHRIST*'s Incarnation, gaue great encouragement to Navigation, and maintained the passage through *Sinus Arabicus*, or the Red Sea, by which the commodities of *India* and *Arabia* were brought to *Alexandria*, and from thence dispersed through diuerse places of *Europe*, *Asia*, and *Africa*. This was after ward seconded and cherished by the *Romans*, at what time *Egypt* was made subiect to their dominion: But the *Roman* Empire being afterwards rent in pieces by the *Goths*, *Vandals*, *Lombards*, and *Saracens*, all traffick betwixt nations began a while to cease; till such time as the inconvenience being knowne, a new Mart was set vp at *Capha* in *Taurica Chersonesus*, belonging at that time to the *Genois*: Thence was it deriued to *Trebizond*, and afterwards to *Samerchand*, where the *Indian*, *Turkish*, and *Persian* Merchants were wont to trade with the *Venetians*. This Art was afterwards set vp and revived by the *Sultans* of *Egypt*, through the passage of the Red Sea, till such time as it was in a manner taken away by the *Portugals*, *Spaniards*, *English*, and *Dutch*; who haue found out for themselves a better way by the Cape of good Hope, to the *East Indies*, and by this meanes much abated the Traffick of *Alexandria*, and the wealth of the *Venetians*. Neither in this Age of ours haue there wanted great Potentates, who haue not only endowed this Trade with great and ample priuiledges; but also themselves practised such

such commerce, aswell for the benefit of their Commonwealth, as the increase of their particular estate. Two memorable examples we haue in *Henry the Third, King of England*, and *Laurence de Medices Duke of Florence*, whereof the former gaue many and large priuiledges to all the *Hart Towns* in his kingdomes, which were in Number about 27: The other himselfe for his owne priuate commodity exercised the Trade of Merchandice: yet was this man most ingenious, and a great louer of learned Men.

C H A P. IX.

Of Pedography, Riuers, Lakes, and Fountaines in the Earth.

- 1  Ee haue formerly treated of Hydrography, or the description of the Water, now are we (by Gods assistance) to proceed on to Pedographie, which is a description of the *Firme Earth*, or *Dry-land*.
- 2 The *Land* is a space contained in the superficies of Earth, distinguished from the Water.

The Earth in this place is not taken as in the former part of Geographie for the whole *Terrestriall Spheare*, composed of Earth & Water: Neither yet as it is vsually taken in *Naturall Philosophie* for an *Absolute Elementary* body, whose causes & affections are to be searched out; but *Topographically* for a place or habitable space on the *dry-land*; This *dry-land* distin-

guished from the Water by it's Firmnesse and Constancy, being not subiect as the Water to motion and inconstancy, was therefore (if we belieue the Poët) called *Vesta*; according to that verse, *Stat vi terra sua, vîstando Vesta vocatur*. Neither wants this fable of *Vesta* a sufficient morall. First, because *Vesta* was fained to be a keeper and protectour of their houses, which may very well agree to the Earth: which not only sustaines and beares vp all buildings and houses; but also affords all commodities and fruits wherewith households are maintained. Secondly, *Vesta* was fained to be the Goddesse to whom the first fruits were offered in sacrifice: which may wel square with the nature of the *Earth*, from which all fruits are originally deriued; and therefore (as it were of due) ought all first fruits to be consecrated to her altar. Two other Parallels betwixt the Goddesse *Vesta* are added by *Natalis Comes*: First, because *Plutarch* sheweth in his *Symposiacks*, that the Tables of the Ancients, dedicated to *Vesta*, were made round in forme and fashion of the Earth: Secondly, because the seat of *Vesta* was imagined to be in the liquide *Aire* immouable, and not subiect to motion: which well agrees with the common conceiued opinion of the Earth. But these two rather expresse the nature of the whole Terrestriall Sphære, then of the land diuided from the Waters: This description of the dry-land separated from the Waters, we haue termed *Pedographie*: because the Greeke *πῆδος*, commonly deriued from *πῆς*, a foot, signifies as much as a firme place, whereon men may haue sure footing, to which is consonant the Hebrew word *רָחַץ*, which seemes most probably deriued from *רָחַץ*, which signifies as much as *Terere*, to weare out or waste: because the Earth is daylie troden and worne with our feet. The proprieties of the Earth appertaining to a *Cosmographer*, are many and various; wherefore to auoide confusion, we haue diuided them into these heads.

3. The Adiuncts of a Place in the Land are either *Naturall* or *Ciuilt*: The *Naturall* are such

such as are inbred in the Earth.

- 4 The Naturall may be againe diuided into *Perpetuall*, or *Casuall*. *Perpetuall* are such as alwayes, or most ordinarily continue the same.
- 5 The *Perpetuall* proprieties are again two-fold; either *Absolute*, or *Comparatiue*. The *Absolute* I call such as agree to the Land without any respect to the Sea.
- 6 Of the former sort are such as belong to the Figurature of the Soile, wherein three things are most remarkable: 1. *Riuers*, *Fountaines*, and *Lakes*. 2. *Mountaines*, *Valleyes*, and *Plaines*. 3. *Woods*, and *Champion Countries*.
- 7 A *Riuer* is a perpetuall course of water from a certaine head or fountaine running from an higher to a lower place on the earth.

Rivers are by some Geographers more curiously distinguished into 2 sorts: whereof the first are settled or stayed Rivers, which slide away with a more equall and vniforme course: The latter are called *Torrents* or stickle waters, which are carried with a farre greater violence. In a Riuer three things are chiefly remarkable: First the *Fountaine* or Spring: secondly *Whirl-poles*: Thirdly the *Mouth* of it. The spring is the place, where at first the water sensibly breakes out of the

Earth: As *Nilus* in *Africk* is thought to haue his first head at the mountaines of the *Moone*. A *Whirle-poole* is a place in a Riuer, where the Water falling into a Deepe trench, is whirled and turned round: The *Mouth* is the place where any Riuer finds a passage out, either into the sea, or into another greater Riuer; which in *latin* is tearmed *ostium* or a gate: Whence they call *Septem ostia Nili*: which are seven mouths, by which it falls into the *Mediterranean*. This gaue the name to many Cities and Towns in England as *Plimmouth*, *Dartmouth*, *Portsmouth*, *Axmouthe*, with many others. Now for asmuch as all water is by nature heauy, and therefore covets the lowest place; The course of all Rivers must needes be from a higher to a lower place: whence we may guesse the hight of lands. For it is necessary that for euery mile wherein the water glides forward on the earth, there be made an allowance of 2 foote at least in the declivity of the ground. For although water will slide away at any inæquality, yet could not the water be wholesome, and retaine any reasonable swiftnes of motion without this allowance. Hence we may probably find out the huge hight of the *Alpes* about all the places in *Europe*: because out of them spring foure great Rivers. which runne foure waies; whereof the two greatest are the *Danow* (which receives into it 60 Nauigable rivers and so disburthens it selfe into the *Euxine Sea* far remote) and the *Rhene*. Of Lakes and Rivers many memorable matters may be spoken: all which we will reduce to these heads. 1 Their *Generation* and first originall: 2 Their *Appearance*: 3 Their *Place* in the earth: 4 Their *Vertues* and effects; all which we will comprehend in these Theoremes following.

I *All Rivers haue their first originall from the sea the mother of Rivers.*

The originall of fountaines and Rivers on the earth is a matter of great difficulty, and for ought I know, not yet found out of our greatest *Philosophers*; yet being willing to goe as farre as I can, I will glaunce at probabilities, and first set downe other mens opinions. Some haue bin of opinion that

that in the bowells of the earth are hid certaine vast concavities and caverns, which receiving into them a great quantity of raine- Water, haue given originall to *Lakes* and *Fountaines*. Hence they giue the reason why these fountaines are perpetuall; Because the raine-water received into these caverns being extraordinary great, is sufficient to nourish such springs of water vntill the next winrer; whence comes a new supply of more raine. These Riueres (say they) in the summer decrease, and sometime are dry, because of the defect of water, when the place is not great enough to receiue sufficient water for the whole year. This opinion seemeth grounded on these reasons: First because we find by experience, that Riueres and fountaines are greater and larger in *Summer* then in *Winter*. Secondly because where there is lesse *Raine*, fewer or no Riueres are sene: As in the Defarts of *Ethiopia* and *Africke*; few or no Riueres are found: But in *Germany*, *France*, *Britany*, and *Italy* many Riueres shew themselves; because they abound in the moisture of the *Aire* and much fall of *Raine*. Thirdly amongst vs (we see by experience) in a hott and dry *Summer* they are much decreased from their ordinary greatnesse, or altogether dried vp; which is a great probability that their originall is from raine. This opinion if it be only vnderstood of some Riueres, may be probable; because some currents out of doubt take their originall from great showers or snowes, as at the foot of the *Alpes* and other such places, where the snow dayly melts and feeds them; but if it be generally vnderstood of all Riueres, it is manifestly false as may appeare by these reasons. First, because the Earth no where drinks vp the raine farther then ten foot deepe in the soile; for the higher superficies of the earth is either dry and so easily drinks vp and consumes the Water within that space; or else being already moist, it receiues it not at all, but expells it by Riueres and channells: Secondly, some mountaines not couered with earth, but consisting of hard rock, notwithstanding send forth great store of *springs* and *fountaines*, which water could not be received in, through a hard rocky substance. Thirdly, because in very dry places certaine pits being digg'd downe in.

to the ground 2 hundred or three hundred foot deepe, will discover many great streames of Water, which could not be from the receipt of *Raine*. Fourthly, it cannot be imagined that so much raine could in a winter fall into one place, besides that which the drouth of the earth consumes, to nourish so mighty and great *Rivers* in the Earth, as are *Rivers* running in a perpetuall course. Fifthly, all *Rivers* almost take their originall from some mountaines or other; as *Danubius* from the *Alpes*, and *Nilus* from the mountaines of the *Moone* in *Africke*; Which places being extraordinary high, are more vnapt to receiue water, then lower places of the earth. To the reasons that they alleadge for their opinions, it is not hard to answer: That riuers should be greater in the winter then in the summer, the cause may be better giuen; Because more moisture of the Aire falls into the brinke from externall Raine or snow in winter then in summer; & the ground being moister, is able to drink lesse then at other times: which is also the reason why in hotter and dry Countries there is not such plenty of *Rivers*: for we deny not, but fountaines may sometimes be increased and sometimes diminished by addition of raine water: but that any such vast concavity should be vnder ground, as the receptacle of so much raine, and should nourish so many and so great currents. The second opinion is of those who thinke that the originall of all rivers and fountaines is from the sea: Which conceit hath bin strongly fortified by many *Fathers* of the Church, and graue *Divines* of later time; which opinion is chiefly grounded vpon these reasons: First because it seemes a most incredible matter, that so much vaporious matter should be engendred vnder the earth, to feed such a perpetuall course of water: Secondly, if all *Rivers* should not be derived from the sea, no reason could be giuen, why so many riuers daily emptying themselues into the sea, the sea should not encrease, but continue in the same quantity. Thirdly to this purpose they vrge the place of *Eccles: 1. All rivers runne into the sea, and yet the sea is not full: To the place whence they came they returne, that they may flow againe.* But this opinion seemes to be shaken with a great difficulty. For it is a hard

hard matter to conceiue how the water of the sea being by nature heauy, and lower then the superficies of the earth (as we haue demonstrated) should ascend into high mountaines; out of which we find springs of water oftentimes to arise: for either it must ascend *Naturally* or by *Violence*: not naturally for the foresaid cause; because it is a heavy body: If violently, they must assigne some externall Agent, which enforceth it to this violence. This difficulty diuerse Authors haue laboured diuerse waies to salue: Some, amongst whom the chiefe was *Theodoret*, haue fled to a supernaturall cause in Gods providence; as though the water in it's own nature heauy, should be notwithstanding enforced to the topps of the mountaines; But this opinion seemes very improbable; because, although we cannot deny Gods miraculous and extraordinary working in some things; yet all men haue supposed this to be confin'd within the bounds of nature: And very strange it were to imagine that almighty God in the first institution of nature should impose a perpetuall violence vpon nature. Others, as *Basil*, haue thought that the sea-water was driven vppwards towards the tops of mountaines by reason of certaine spirits enclosed in it: *Mare (as he saith) sinitans & per means per cuniculos fistulares & angustos, mox ubi obliquis aut certe recta in sublime surrectis excursibus se occupatum deprehenderit ab agitante compulsum spiritu, superficie terre vi disrupta erumpit atq; foras emicat*; The same opinion almost in every respect is ascribed to *Plato* in *Phadone*, & *Pliny* 2 booke. 65 chap. *Quo (inquii) spiritu, actu & terre pondere expressa siphonum modo emicat, tantoq; a periculo decidendi abest ut in summa quoq; et altissima exiliat: Quae ratione manifestum est, quare tot fluminum quotidiano accessu maria non crescant*. But this exposition will hardly satisfy him who desires to search farther then obscurity of words: For first by admitting spirits as movers of the waters, they seeme to fall into a *Platonick* opinion before examined of vs concerning the heat of the sea-water. Secondly, I would demand whither such spirits in the water to which they ascribe this motion, be *Naturall* Agents or *Supernaturall*, or *Violent*: They cannot be naturall Agents: For

as much as they are supposed to drive and enforce the water against his owne nature. For by nature (as all men know) it is apt to descend; whereas here it is supposed to ascend by reason of such spirits. They cannot be violent agents because they bee perpetual; whereas no violent thing can be perpetual. *Thomas Aquinas* being desirous to shew, how much fountaines could ascend out of the sea-water varies in opinion from the former, and imagines that the fountaines and *Rivers* water is drawne vpwards through the force of *Celestiall bodies*, for the common good; to wit that it might water as well the *mettalls* in the bowells of the earth, as give moisture and nourishment to *Plants*, and living creatures, dwelling thereon. And this motion (saith he) although it be against the particular nature of the water, is not altogether violent: because elementary bodies are bound by a certaine law to obey and subiect themselves to the heavenly; so that motions impressed by them, are not enforced on them by violence. For albeit in some sort it thwart the *physicall* disposition; yet have all creatures an *obedientiall* aptnesse (as they terme it) to submit themselves to the superiour. But this opinion of *Thomas Aquinas* (in my conceit) seemes lesse sound then the former: For first *Thomas* had no need at all of these shifts, holding some of his other grounds: For in another place, comparing the height of the sea and land one with the other, he firmly maintaines that the sea is above the land; and that it is bounded and restrained from overflowing the dry land, by the immediat power of the Creator: If this be graunted, what need there any ascent or drawing vp of the water, by any externall power of the heavenly bodies: sith the remitting of this restraint of waters in some places, were sufficient to cause such *springs* and *rivers* in the earth: Secondly, his opinion cannot stand without manifest contradiction of himselfe; for how can the water, being of his owne nature heavy, be drawne vpward without violence and thwarting of nature: And whereas he alleadges for himselfe an *obedientiall* aptnesse in the elementary bodies to obey the superiour, he shall find very little help to maintain his part. For this *obedientiall* inclination must be either accore ding-

ding to the nature of the water, or opposite vnto it, or at least the one must be subordinat vnto the other: That it is according to the nature of the water, he himselfe disclaimes, and experience refutes; because it naturally *descends*, not *ascends*: if it be opposite (as indeed it must needs be) he contradicts himselfe: If the *Physicall* and *obedienciall* inclination be *subordinat* the one to the other; I vrge that subordinat causes can produce no other then subordinate effects; for asmuch as the causes and the effects are measured and proportioned the one by the other. But wee plainly see that the motions of ascent or descent are diametrically opposed, and contrary the one to the other; so that they cannot otherwise proceed, then from opposite and contrary causes. Secondly this *obedienciall* aptnesse, is commonly vnderstood of a creature, in respect of his Creator, in whose hand it is, as to create all things of nothing, so to reduce all things again into nothing. But this although it be about nature, yet no way contradicts nature: and easier it is to be imagined, that the *Creator* should annihilate any *Creature*, then letting it remaine in his own Nature, giue it a motion against nature: Moreover if we duly consider nature in her course, we shall find that the *lower & elementall Bodies* onely concurre to the conseruation of the *whole*, and of one another, by following their own priuate inclination: for the whole is nothing else then an orderly concent and harmony of all the parts; from whose mutuall cooperation, it receiues his perfection; so that where any part failes in his owne office, the whole must needs sustain dammage. Thirdly, it will hardly be resolu'd by any of this opinion, by what meanes or instruments the heavenly or superiour Bodies can haue such an operative power ouer the water, as to lift it vpward from his owne Center: for neither can this thing be performed by *motion*, *light*, or any *Influence*, which are the three meanes of operation of *celestiall Bodies* on *elementary*: I will not stand to proue euery particular in this matter: But onely would haue my aduersary to answere, and giue an instance and speciality. Another opinion there is of *Aristotle*, followed by all *Peripateticks*, who in his first booke of *Meteors*, and 13 Chapter,

goes about to proue and maintaine, that all *Springs* and *Wells* in the Land are produced and generated in the bowells of the Earth by airy vapours resolued into water: which opinion he labours to strengthen in this manner. It is certain (saith he) that the Earth hath within it much aire; because *Nature* will no-where admit a *vacuity*. But the Earth hath not onely many open, but a great many secret holes and concavities, which cannot otherwise be filled then with aire. Moreover a great part of the Earth, and other vapours therein contained, and stirred vp by the force of the Starres, are converted into Aire; and that aswell the Aire included in the bowells of the Earth, as vapours there also bred, are perpetually converted into water: This reason may seeme to perswade, because it followes of necessity, that the coldnesse of the Earth expelling their heat, they should harden & condensate, & be disposed at last to the generation of water: whence also the cause is giuen of the generation of water in the middle Region of the Aire, although it be not alwayes thence bred: aswell for other causes, as for that the Aire by the heat of the Sunne is sometimes too hot, and the vapours are too much attenuated and rarified: so that the matter of Raine cannot be alwayes supplied. This would *Aristotle* haue to be the the originall of all *Springs* and *Fountaines*; So that the water should first distill as it were drop by drop, out of this vaporous matter: and this moist matter so collected and drawne together, should afterwards breake forth out of the ground, and so cause such fountaines. Some reasons are also produced to proue this assertion; for (say the *Authors* of this opinion) If the *Springs* and *Riuers* should proceed from any other cause, then they should take their beginning from *Raine-water*, which is before refuted; or from the Sea by certain secret passages, which opinion seemes too weake to endure examination: First, this seemes an argument, that the *Sea-water* is commonly *Salt*, but the water of *Springs* and *Riuers* is for the most *sweet* and *fresh*; and therefore such *Springs* are not deriued from the Sea: Secondly, because we neuer find the Sea to be emptied, which must needs be, if it should giue beginnings to all such currents of water

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in the Earth; Thirdly (we haue already shewed) that the *superficies* of the Earth is higher then the Water; so that it cannot be conceiued how riuers should be deriued from the Sea. To this opinion, howsoeuer seeming probable, and supported with the name and authority of so great a *Philosopher*, I dare not wholly assent; forasmuch as it thwarts the Testimony of holy *Scripture*, and cannot otherwise stand with reason: because it cannot well be imagined how so many vapours, and so continually, should be ingendred in the bowels of the earth, to nourish so many and so great currents, as we see springing out of the Earth: for a very great quantity or portion of *Aire* being condensed and made Water, will become but as a litle drop: The *Aire*, according to *Aristotle's* grounds being by a *Tenne* fold proportion thinner then the Water. Moreouer the *Aire* in these places seated in the *superficies* of the Earth, and higher then other places, and by consequent nerer the Sun, should rather be *rarified* and *thickned*; because heat is the greatest cause of rarification, as we shall shew hereafter: for the reasons allledged for these opinion, they are drawne only from the weaknes of their assertion, which hold that *Fountainaines* are deriued either from *Raine water*, or from the *Sea*: both which wee haue examined briefly, and whereof wee shall speake hereafter. The Schoole of *Conimbra*, not vterly reiecting all the former opinions, haue vndertaken to forge an opinion (as it were) partaking of all, pretending to say something more, when indeed they produce nothing besides the former. Their Assertion they haue set downe in eight propositions, which I will faithfully set downe, and then censure. The first is that in *subterranean* places vnder the superficies of the earth, is hid a great quantity of water, distinguished into *Rivers*, *Ponds*, and *Lakes*. This they proue from the daily experiment of such as diggs diuerse wells and deepe trenches in the Earth; Who many times vnder the Earth, find not only many rivers and ponds, but many times happen vpon so great abundance of Water, that they can neither find the bottom or bounds thereof. To this they add an experiment of *Philip of Macedon* recorded by *Aeschyladorem*

who caused many men expert in digging of mettalls, to be let downe into an old and forsaken mine to search out the veines of mettalls, to see where the covetousnesse of antiquity had left any thing to posterity. These men vsing great lights are said to haue found nothing there, but great and vast riuers and great receptacles of waters. This they also labour to confirme by many and suddaine eruptions and breaking out of waters out of the earth, whereof we shall haue occasion to speake more heereafter. This first position, howsoever in it selfe true enough, seemes litle to the purpose; but we will proceed to the second, which is this: That when God in the third day of the Creation separated the waters into one place, and hidd it in the caverns and secret receptacles of the earth; at the same time dispersed into diuerse parts of the earth, a great quantity of water by diuerse occult passages and channels, whence comes that great masse of waters vnder the earth; which is before mentioned. This they seeme to persuade by reasons; for (say they) as the wise *Architect* of all for mans sake, and the rest of living creatures for the vse of man, hath discovered the dry land, by restrayning all the waters into one place: so it was most necessary, that he should inwardly water the earth; by which *stones, mettalls, minerals, &c* other such things in the bowells of the Earth, should in time grow and increase. Also that some water should from hence breake vp out of the Earth, for diuerse causes heereafter specified. Finally as *Philo-Iudæus* affirms, for the continuat'on of the parts of the earth, which otherwise might by drouth be separated and diuided. The third proposition grounded on the two former is this; That many riuers and fountaines in diuers places by God's decree arise out of the earth, by quantities of waters hid in the cavernes of the earth, which they proue by reasons drawne from the vtility of such fountaines and riuers, springing out of the earth. Fourthly they defend, that all fountains and currents were not so made and appointed in the first Creation; because Histories & experience teach vs, that many haue broken out of the ground afterwards; whereof we shall haue occasion to speake heereafter. Firstly they

they affirme, that if the opinion of *Aristotle* be understood of all fountains and floods, it cannot be approved; for as much as it seemes sufficiently declared in the third opinion, how such rivers might be generated without such vapours; as also because many arguments and places of *holy Scripture*, seeme to proue the contrary. As also the foure Rivers of *Paradise* created in the beginning of the world, cannot be guessed to draw their originall from such vapours, as *Aristotle* imagines; to which accord many ancient *Fathers* vpon these places recited in that opinion, whereas all rivers are thought to fetch their originall from the sea. Sixtly for the credit of their master *Aristotle*, they are constrained to averre that although his opinion cannot be verified of all rivers and fountains of the earth, yet if it be restrayned to some such perpetual currents, it may haue probability. Forasmuch as we are to belieue that many such large caverns and holes are hid vnder the earth, in which no small quantity of vapours may be ingendred. This probability is greater in those riuers which are lesser in quantity then the greater, for the reasons before shewed. Seventhly they affirme that it is absolutely to be believed; that not only great rivers and currents are derived from subterranean waters, which haue originall from the sea; but also lesse fountains and springs for the most part, challenge the same beginning: whence they labour to proue by this reason, that in very few places of the earth there is found so perpetual and apt disposition of vapours vnder the ground as to nourish so many and so great currents of water. Eighthly (say they) it cannot be denied, but that Waters aswell proceeding from raine, as that which is generated of vapours in the caverns of the earth, sometimes may flow into fountains and rivers: What concernes Torrents bredd of raine, they haue recourse to the reasons of the first opinion: for others they make it also probable; because we see by experience that Vapours and Aire compassed about with earth, are by reason of the cold environing it, turned into water. This is indeed the opinion of those subtill *Iesuits* of *Conimbra*, wherein although they giue a flourish, as if they would defend their

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master *Aristotle*, on whom they comment; yet meane they nothing lesse; but indeed warily sticke to the other of the *Divines* and *ancient Fathers* of the Church, touching the derivation of all torrents from the sea: Which opinion, howsoever in it selfe most probable, they know not how to manage and defend against opposition. For whereas they suppose that in the first separation of the *sea* from the *dry-land*, a great quantity of water was dispersed into diverse hollow places & caverns of the earth, from whence Rivers are derived and made; they haue not in any probable manner expressed, how this water should perpetually flow, and feed so many & great currents: For first, I would aske of these learned fathers, whether the water inclosed in the bowells of the earth, whence these springs are fed, be *higher* or *lower* then the fountaines arising out of them. If it be higher; whither the Rivers are continually nourished on the old store, or a new supply be daily made. That so great rivers should be maintained so many thousand yeares out of the old provision, is most improbable; because the mountaines out of which such springs arise, cannot be capable of so great a concavity: neither can it otherwise be imagined, but that many great rivers since the beginning, had either bin absolutely dried vp, or at least diminished in their quantity, their Cisternes being daily more and more emptied out into their channells. If they graunt that of this water, a fresh supply be made; it must be either from the *sea* or from *vapours* in the *earth*. It cannot be from the *sea*; because (as we haue proued before) the *sea* is lower then the fountaines, where springs breake out of the Earth; for asmuch as we see them runne to the sea from their fountaines, as from a *higher* to a *lower* place. That this supply of water in the depth of the earth should be made by *vapours*, it is also improbable in their opinion; who cannot imagine so many ingendred in one place, as to feed so great currents; as also because many rivers were apparant in the first *creation*, as the foure great currents of *Paradise*. This obiection hath so farre driven the *Iesuits* to their shifts, as that they haue bin enforced to haue recourse to the opinion of *Thomas Aquinas*.

Aquinas, who dreames that the waters are enforced vpwards, by the influence of the *heavens*, which they a litle before cast by, and we haue before sufficiently refuted. And whereas in the subsequent clause, they labour to salue this place of *Ecclesiastes*: *That all Rivers come from the sea, and returne thither againe*; They are constrained to leaue their old grounds, and runne backe to *Aristotle*, who holds that all rivers had their originall from *vapours*, drawne vp by the sunne; whereof the *sea* is the chiefe mother. It wilbe expected at least that we should disclose our owne opinion, hauing censured the former: which we will briefly doe as neere as probability can lead vs, submitting all to those which are more iudicious: First therefore, we will suppose as probable: that the earth is in a manner compassed round about with water; for howsoeuer the places more eminent, and separated for our habitation, be dry land, yet not farre vnder the superficies of the earth, whereon we tread, is the earth sprinkled round with water, for which we may draw an argument; as well frō the *Porous* and *spongy* nature of the *Earth*, which is apt to drinke in the water of the *sea*, in the same hight; (because it is the nature of the water, to diffuse it selfe abroad) as also from experience of *Miners* and such as digg deepe into the earth, who in most parts find water. 2^{ly}, this water so environing the earth, were it left to it's own naturall situation, without an external Agent, would lift his superficies no higher, then the superficies of the *sea*; because being as one with the *sea*, it will challenge the same *Spharicall* superficies. Now to know how the water thus naturally settled, is notwithstanding lifted vp higher to become the source of Springs, we must vnderstand, that it comes to passe not onely by the heat of the sunne and *starres*, piercing farre vnder the superficies of the earth, according to the circle, we haue allotted to the water. But also to *subterranean fires* hid in the bowells of the earth, in many places: which are caused by *sulphurous* matter set on fire by the sunne, or some other accident: whether this *sulphurous* matter be pure *Brimstone*, or *Bitumen*, or a mine of *sea-coale*, as some haue thought of our *Bathes* in *England*, I

will not curiously here dispute, being of it self too large a subject for me in this place to handle. This *heat* may be conceived to concur to the production of fountaines 2 manner of waies: First, by drawing vp diverse moist *vapours*, which by reason of the *thicknesse* and solidity of the earth, being not presently evaporated out of the superficies of the earth, are enforced to disperse themselves through divers crooked passages, where condensed by cold distilling againe into drops of water, they breake out through some place of the earth, and so become a fountaine. A second way which may also seeme probable, is that the *Heat* pearcing the *Subterranean Water*, though not able to dissolue much of it into vapours for the solidity of the earth, may notwithstanding through his heat, *Rarifie* and attenuate these waters. These waters then raised, must needs seeke a greater place, wherein they may be contained: sith *Rarefaction* is nothing else but the extension of a body to a greater place then before it occupied. Hence is the Water enforced to enlarge his limitts: This enlargement or the place cannot be downward towards the Center; because all that place was supposed to be filled vp as farre as the Earth could drinke it. Wherefore it must needs extend it's limits *sidewise* or *upwards*: By the former of which it may find a passage to breake forth on the superficies of the ground: By the later it may be lifted high enough, to runne from the side of a higher mountaine, towards the *Sea-shore*. If any man should aske why this *Rarefaction* & swelling of the Water is not so sensible in the open *Ocean*: I answer that the sea is also much rarified and lifted vp by reason of the sunnes heat: which whether it be the cause of ebbing and flowing of the sea, in part we haue before disputed. Secondly that the *sea-water* should not rise so high as other Water vnder the ground, these reasons may be giuen; First that the *Ocean* hath a larger channell to runne abroad on either side, and so this swelling must of necessity become more insensible, whereas the Waters in caverns & concavities of the Earth, being oftentimes straightly bounded on either side, by the narrownesse of the channell, must of necessity take vp the more in hight & eminency. 2

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the *Sunne*, *heavenly bodies* and *subterranean fires* worke more strongly and effectually on the open nakednes of the sea, then on the waters hid vnder the ground, which are more shrowded from such an extreame heat. Whence it comes to passe, that many parts of the *sea*, are dissolued into *vapours*, and so consumed and dispelled by the same; Whereas this heat in the *Subterranean* waters being more moderately impressed; doeth not dissolue into vapours, and consume so great a quantity of water; but being of a middle temper, rather rarifies it to the vse forenamed. This seemes the more probable, because spring water rising commonly in the sides of mountaines, is for the most part thinner then the Sea-water, as experience daily warrants. Thirdly, the *subterranean* vapours are sooner dissolued into dropps of water by reason of the cold they must necessarily meete within their passage, through the *Earth*; whereas the other from the *Sea* meet with no such encounter till they arriue at the *Middle-Region* of the *Aire*, whence they returne againe in showres of Raine.

2 *All Riueres and Fountaines were not from the beginning.*

For the confirmation of this assertion, many histories may be produced: It is reported that in *Caria* nere about the city *Lorus*, there arose out of the *Earth* suddenly a great floud of Water, bringing out with it a great quantity of creatures and fishes, of which being fatted vnder the *Earth*, whoesoever chanced to eat, dyed presently. The like is reported, that at the time of the *Mythridatick* warre, at a certain city of *Phrygia* named *Apamea*, there sprang vp out of the ground many new *Lakes*, *Fountaines*, and *Brookes*; and that one riuer sprang vp very salt, which brought vp with it a great quantity of *Oysters*, and other *Sea-fishes*; although the City *Apamea* be very farre off from the *Sea*. This is reported by *Nicolas Damascene*. Also *Cardinall Contareus* testifies in the second booke of *Elements*, that in a cleare day being in *Valentia* in *Spaine*, there happened a very great *Inundation* of water breaking out of the *Earth*, which being carried towards the City,

had well nere turned it into the Sea, had not the gates bin shut, and damnes well ordered. Why this sudden change should sometimes happen, many reasons may be produced. The first reason may be, because of some iuddaine ruine or falling downe of some parts of the Earth, whereby the courses of the riuers being one way stopped, must needes seeke out a passage some other way. This oftentimes happens in great *Earth-quakes*, as we may read in *Theophrastus*, that in the mountaine *Coricus*; after an *Earth-quake* many new springs and fountaines discovered themselues. Another reason not much vnlike the former is giuen from the *Hardnes* of the Earth, which oftentimes stopping and hindering the naturall course of the water, enforceth it to seeke a new passage. Hence the foresaid *Theophrastus* was induced to belieue, that in a City of *Crete* the fountaines were stopped vp because the Inhabitants betooke themselues to another place; so that the soile was not so much shooke and moued as before. A third reason may be the wasting or cutting down of great woods on the Earth; for it is the nature of the Trees and plants to suck to themselues the Moisture of the ground into one place. But these trees cut downe or remoued, the waters course must needes be altered.

3. *Many Rivers are for a great space of land swallowed vp of the Earth: whereof some after a certaine distance rise againe.*

This is confirmed by many historicall instances, as of the river *Timanus* in the province of *Aquila*, of *Erasenus* in *Argolica*, *Padus* in the *Alpes*; more remarkeable is that of the river *Guadiana* in *Spaine*, which runneth vnder the ground, for the space of 13 leagues, and neere to a towne called *Villa Horta* breakes vp againe: the like is the order of *Eurotas* in *Arcadia*, which is said to breake forth of the ground in the province of *Lacedamon*: So *Cadmus* in *Asia* is swallowed vp in a hole of the ground, not farre from *Laodicea*; so *Pyramus* in *Cataonia*, *Licus* in *Libanon*, *Orontes* in *Syria*. Other riuers are thought to haue found a secret passage vnder the sea from one Region to

another : As a riuer hauing his fountaine in the mountaine *Meates*, which being conuayed in a blind Chaunnell vnder the middle of the sea, comes forth againe at the port of *Parormus*: so others report of *Alphens*, which being drowned vnder ground nere the *Peloponnesian* shore, takes a large iorney vnder the Sea, till it ariue at *Syracuse*, where it ends in *Arethuse*; which brings forth (they say) such things as are cast into *Alphens*: which is much like that which is spoken of the Well of *Esculapius* in *Athens*, wherein if any thing were cast, they were rendred againe in *Phalericus*: But this last I rather hold as a poetick fiction, then a true History. Some riuers there are which are not wholly drowned in the earth; but for some part; as a part of the *Rhone*, which is hid about foure thousand paces from the city *Cauba*, and shewes it selfe againe before it come to *Bonna*: in like manner a part of *Danubius* which hides it selfe about *Greina* a Towne of *Pannonia* superior: some riuers there are againe, which are not drunke vp immediatly of the earth, but of certaine great *Lakes* into which they fall; as *Iordan* of the Lake *Asphaltites*: some lakes againe hauing swallowed vp riuers (as it were) vomit them forth againe; as *Rubresius* casts out *Arace* in the Prouince of *Narbon*; and so *Lemannus* the riuer *Rhodanus* in the same Prouince: also in *Italy*, *Lernus* casts out *Abdua*; *Eupilus*, *Lambre*; *Fucinus*, *Marcia*.

4 Riuers for the most part rise out of grent Mountaines, and at last by diuerse or one Inlet, are disburthened into the sea.

The first part of this proposition is manifest enough out of diuers instances of the greatest rivers in the world: for all Geographers will giue you to vnderstand, that the riuer *Indus* in *India* is deriued from the mounraine *Caucasus*. *Tanais* from the *Riphaean* mountaines in *Sarmatia*, *Araxis* from *Panardes* in *Armenia*, *Po* from the *Vesuvian* Hills in *Liguria*, *Danubius* from *Arnebia* in *Germany*, *Exesus* in *Norico* from the mountaine; *Elachâ* *Isara* from the ridge of the *Alpes* toward *France* and *Durius* toward *Italy* from thence. So from the *Hermanian*

mountaines in *Portugall* are deriued three great Rivers: So *Nilus* in *Africk* from the mountaines of the *Moone*: These rivers thus rising, are of diuerse kinds; for some haue visible apparant *springs* and fountaines: others are deriued from *Lakes*, out of which they runne. As *Alba* in *Prusia*, out of *Elbinga*, *Medoarus* & *Oxus* out of two lakes of the same names, neere the *Alpes*; *Rindacus* from *Artinia* a poole besides *Melinopolis*. The reason why rivers should be ingendred in mountaines, and such high places, may be given; because they are made (as we shewed before) by the heat of the sunne, starres and subterranean fires, rarifying and attenuating the Waters. And this operation of the sunne in higher places, must needs be more effectuell then in lower. Now for the second part, it is plaine to proue, that all rivers run into the sea: either making a passage from their fountaines, on the land toward the sea shore, as *Nilus* & *Danubius*, with other rivers, or by disburthening themselues into greater Rivers, wherin they are conuaid into the sea: as the 60 great Navigable rivers, which emptie themselues into *Danubius*, or at least are swallowed vp of the Earth, and so reduced againe to their first mother; which we may imagin of the rivers forespoken of, drunk vp of the Earth: Although all rivers (as we shewed) fall into the sea, yet not all in one & the selfsame fashion; if we respect their passage on the land. For some are caried into the sea by one *ostium* or mouth, whereof we haue two notable examples; the first of a great river in *Brasill* called *Rio de La Plate*, which is caried into the sea, by a mouth of 40 leagues, with such violence, that the Mariners may thence draw fresh water before they come within sight of land. The other not much vnlike, is that which runnes by the kingdome of *Congo* & *Angola*, which is six and thirty thousand paces broad, where it enters into the sea, and is carried with such a force, that it severs the waues, & keeps his owne channell, and renders the shipp-men fresh water betwixt the sea waters, for the distance of eight hundred thousand paces. Other great rivers are disburthened into the sea, by diuers *ostia* or *Inletts*; as *Rhene* into the *German Ocean* by three; *Danubius* into the *Ponticke* sea, by 6; *Indus* into the

the *Indian sea* by 7; *Nilus* into the *Mediterranean* by 7 great and famous passages: *Volga* into the *Caspian lake* by 72 gates. These are the most remarkable: others we shall supply in our *historicall* part.

5 *Diverse fountaines are endowed with diverse admirable vertues and operations.*

There is nothing wherein *Nature* delighteth more in miraculous variety, then in fountaines and springs of the earth. Of these admirable workes of nature, being infinite in these springs, I will touch some. Which the better to effect, I will reduce all to these heads: 1 Their *qualities* and operations. 2 their *Motiós*: For the former we will produce some few instances. It is reported, that neere the *Garamantes* there is a fountaine so cold in the dayes that no man can drinke thereof; so hot in the nightes, that no man can abide to touch it: There is another in *India* wherein a candle will burne. There is also another called heeretofore the well of *Iupiter Hammon* which in the morning is luke-warme: at noone cold, in the evening Hot, at midnight *boiling hot*; From whence againe it begins to assuage till the morning; and so (as it were) by turne it growes *hott* and *cold*; a matter of great admiration. Some fountaines in *Liguria* & *Paphlagonia* being drunke will make the head giddy as if he had drunke wine: Another fountaine in *Aranea* a part of *Arcadia* being drunke, will so affect the tast, that who drinks it shall neuer afterward endure the tast of wine: which was very like the fountaine *Clitorius* wherof *Ovid* in his *Metamorphosis* the last booke sings in this manner: *Clitorio quicunq; sitim de fonte levârit,*

Vina fugit, gaudetq; meris abstemius undis.

The ancients haue also recorded, that in *Bæotia* neere the river *Orchomenon*, are two fountaines; whereof the one gets *memory*, the other causeth *oblivion*. There is in the Iland *Cea* a fountaine making the senses dull; another in *Ethiopia*, whereo the Water drunken will make a man madd: Some water absolutely kils him which drinks, as the river *Styx* in *Arcadia*, being a venomous fretting poison, and therefore by

by the poets fained to be one of the riuers in Hell. Divers other riuers are profitable to cure diuers diseases of the body, whereof I need not bring any instances; because such new-found wells are sometimes discovered amongst vs here at home. There are 2 riuers in *Bœotia* of admirable vertue, whereof the former, if a sheep drinke of it, he will become yellow: but if a sheep of a dunne or yellow colour drinke of the other, he will become white: Rivers which make sheep white coloured besides, are *Neleus* in *Eubœa*, *Alacmon* in *Macedonia*: *Crathris* in *Thuryis*: so *Cerens* in *Eubœa*, *Auxius* in *Macedonia*, *Peneas* in *Thessaly*, will make them blacke: *Clytemnus* will cause whitenesse in oxen: So the riuer *Astaces* in *Pontus* waters the land, wherby mares haue their milke blacke. Amongst the regions of the *Troglodites*, there is a well which thrice a day will become sweet and bitter, and againe returne to his former sweetnesse, and so often againe in the night. This may suffice to shew the variety of operations in these wells, in respect of other creatures. No lesse admirable variety is discovered in obseruing of their diuerse motions. For some riuers ouerflow their bankes at some certaine times of the yeare, as *Nilus* in *Egypt*, *Euphrates* in *Mesopotamia*, *Indus* in *India*: some fountaines are carried with such violence, that they cast vp stones, as *Marsia* in *Phrygia*, and expell any weight as a certaine one in *Arabia*, whereof the like was recorded to be in *Portugall*: some will swallow vp any thing throwne into them; as one in *Portugall*, if we belieue *Pliny*: some others although they are cold, will seeth and seeme to boile as the water on the fire; yet neuet cast out their water beyond their bankes, but straigh-way swallow it vp againe, as *Acidula* in *Albogano*, and another fountaine in *Cappadocia* named *Tiana*: some there are which sometimes rise and swell, and other times fall againe of their owne accord, as *Crater* of *Turinge*, and a fountaine in *Italy* called *Pluviana*: some wells imitate the ebbing and flowing of the sea in all encreases and diminutions, as one in *Cales*, and the other neare *Burdeaux* in *France*: some are contrariwise affected to the ebbing & flowing of the sea; flowing when the sea ebbs, and ebbing when the

sea

sea flowes as certaine *Pits* in *Spaine*: some encrease and diminish without any consent or agreement with the motion of the sea; as a Well in *Tenedos*, an Island neare *Troy*. In *Cantabria* are three fountaines, distant 8 foot the one from the other, and falling into one Channell in a vaste riuier, which euery day are dry twelue times, and sometimes twenty times: others of their own accord purge & cleanse themselues, casting out wood, clay, durt, & other matters wherewith they are defiled, as a Well in the *Chersonesus* of *Rhodes*. These and many more remarkable instances haue our naturall Historians gathered together, whereof though some perhaps may be thought to be forged of Poets for pleasure, or mistaken for want of good discouery and obseruation; yet must we not wrong *Antiquity* so much as to reiect all, hauing in this subject enough to wonder at in our owne Country.

6 *Places neare great Riuers and Lakes are most commodious for habitation.*

It hath bin the custome of all times and nations almost in the world, to choose out for a choice place for building of cities, their habitation neare some great *Lake, Riuer, or Arme* of the Sea; which sprang from the common obseruation of Men, who found such places to be more convenient. This conueniency is shewed many wayes: first, because by meanes of such water they haue quick *passage* and *trafficke* with other Nations, being able with more ease both to receiue, & to send forth wares and marchandise. Whence we see that such cities as are seated vpon the wauer, are commonly of all other the richest: whereof we may giue an instance almost in euery countrey, as of *Senill* and *Lisbone* in *Spaine* & *Portugall*: of all the Cities almost of the *Low-countries*; of *Paris* in *France*: whence (no doubt) grew that English Prouerbe; *That the Sea is a good neighbour*; which may aswell be vnderstood of any navigable Riuer. Secondly, such a site is most convenient for the *purging* away of all *silt* and *excrements*, which could not with the like conueniency be so soone transported by land: whence many men haue laboured to transport riuers far

remote vnto Cities. Thirldly, because such riuers and watry lakes yeeld store of *fish*, whereby the Inhabitants may be nourished, and other creatures the better preserved: Fourthly, no small commodity would accrew to a City by water neare adjoyning. If it should chance (as often it doth) to be set on fire; for hauing water neare it, it may soone be quenched: whereas many little springs cannot afford so much water as would suffice for such a purpose. Lastly, amongst other reasons we cannot forget the pleasantnes of faire riuers, which are no sma'l ornaments to a City, and delights to the eye of the Inhabitants.

8 Thus much for rivers: A Lake is a collection of perpetuall Waters, nourished with fresh springs, and having of it selfe no passage forth.

In this definition of a Lake, we haue comprized these three things: First that it is a collection of constant and perpetuall waters: Secondly, that it is continually fed & cherished with fresh springs, rising vp from the bottome. Thirdly, that it finds no passage forth into the sea or otherwise. By the two first it is distinguished from a great Pond or standing poole called in Latin *Stagnum*: For asmuch as a standing poole, being commonly fed with raine water, and hauing no springs from the Earth whereby it may be long nouished, is oftentimes by the heat of the sunne exhausting it out by vapours, either extraordinarily diminished, or altogether dried vp: Whereas in a Lake by reason of fresh springs, the Water is perpetuall and remaineth sweet and holsome, except by some other accidents, it change it's disposition. For the latter clause that a lake finds no passage forth, it may be two waies vnderstood: either of a *visible* or apparant passage outwardly through the superficies of the Earth to the sea, or of a *secreet* and subterranean passage vnder ground: The former may againe be vnderstood of a passage forth immediatly by it self, or mediately by some riuer: whereas wee haue said that it

finds

finds no entrance into the sea, we ought to vnderstand it, that immediatly it is not to be accompted a continuat part conioyned with the sea: neuerthelesse it may be disburthened into the sea by some rivers running out of it, as some would haue the great river *Tanaïs* not to haue his head or fountaine in the *Riphean* mountains, as the ancients haue taught, but in a certaine Lake not farre from the city *Tulla*: so *Volga* & *Edil* draw their originall from a lake not farre from *Moscow*: with many others of like nature. What to thinke of the *subterranean* intercourse betwixt *Lakes* and the sea, we will shew in this Thoreme.

I It is probable, that most Lakes haue some secret intercourse with the sea vnder ground.

For the confirmation of this point, there want not reasons: The first reason may be drawne from the quantity of Water in most Lakes, which is found without any great sensible difference to remaine the same, without any dimiuntion or encrease; whereas if the water bound in with these limits, should haue no passage out any way, it should encrease to such greatnes, that it would easily over-whelme the bankes. To giue a few instances, we find that diuerse very vast rivers exhaust themselues into the *Caspian* Lake as *Volga* & *Edil*, which receiving into them many notable riuers, are at last themselues swallowed vp in the said lake: In like manner the Lake of *Palestine* called the dead sea, is known to receiue into it besides diuerse lesser rivers, the great and famous riuier *Iordan*. Heere would I demaund, whether these great riuers perpetually casting themselues into a Lake, giue an encrease to the former quantity or not: if they should augment the water, they would by consequence alter the bounds: But this is contradicted by experience. If the quantity of the water suffers no encrease, it must needs follow then, that the water should some other way be diminished, as it is heere encreased. This must either be by the sunne drawing vp some parts of it by vapours, or by some caverns of the Earth, drinking vp some parts of it: Or lastly by a *subterranean* passage into

the sea: Concerning the former it cannot be denied, but much Water is drawne vp into vapours by the heat of the sun, yet that these vapours countervale the water perpetually brought in, is in my conceit very improbable: for against this quantity of water extracted out this way of *evaporation*, I will oppose these three things which shall perswade a reasonable man, that the water received in, shall farre surpass the vapours exhaled from it: First that the vapours are stirred vp in the day time, when the sunne is lifted about the *Horizon*; at such a height that his heat is somewhat strengthened, whereas all these watry currents neuer intermitting their vsuall course, neuer cease to runne by *day or night*: wherein is scene a double advantage of the riuers, in respect of the watry exhalation: Secondly of these watry vapours, so drawne out, a great part must at diuerse times retorne back, or at least so much otherwise by *rainy* showres, dropped downe into this *Lake*. Thirdly, these watry parts thus rarified & attenuated in vapour should (putting this supposition) in equality, diffuse themselves abroad in such extraordinary manner, that all the Regions round about should in all likely-hood suffer a great inconueniency of foggy exhalations. On the other side it is very vnlikely, that it should bee receiued into empty caviens of the Earth, without passage into the sea, or some great riuor disburthening it selfe therevnto. For I would demand whether these cavernes were euer filled with water or not: if they haue bin filled, how could they receiue more water, sith the filling of any place supposeth it to be first empty. That they were neuer yet filled with Water, is farre more vnreasonable: that any man should imagine, any caviens of the Earth to be so vast, which so great currents of Water perpetually running in almost six thousand yeares, should not replenish: especially considering the bowells of the Earth, not farre from the vpper face, to be every where spread with Water round, which might also helpe to this purpose: Wherefore it cannot well be imagined but that euery such great lake, hath some vent or passage vnto the sea, either by some *secret* & subterranean channell, or

at least by some great river issuing out of it, and so running into the Ocean. Another reason may be taken from the currents of some seas, which are by good reason ascribed to this cause: For it is observed by skilfull Naugatours, that the Water is carried by a very stiffe course from *Propontis* and the black sea into the *Aegean*, and from thence into the *Mediterranean*: The originall of which current may with good conjecture be found out in the *Caspian*, which by some secret passage vnder ground, disburthening it selfe into the black sea, causeth it to enforce his owne waters farther of, for the receite of the other. Thirdly that these subterranean passages are not unlikely, may be confirmed by many rivers which are swallowed vp, some wholly, some for some place only of the Earth, whereof we haue spoken before. Also it may seeme likely by the Water, spread round about the Earth, which through the bowells of it finds a passage from the sea, bearing as it seemes the same leuell. This may (for ought we know) be the originall of all *Lakes*; and this also may be a way or meanes, whereby they empty and disburthen themselves, being overcharged with too much Water.

CHAP. X.

Of Mountaines, Valleys, Plaine Regions,
Woods, and Champian Countryes.



The second variation in the figure of the Earth is expressed in Mountaines, Valleys, and Plaine Countreyes. A Mountaine is a quantity of Earth heaped aboue the ordinary height

of the Land. A Valley is the depth of the Earth between two Mountaines. A Plaine is a space of Earth where there is found no notable rising or falling of the ground.

The distinction of the Earth according to it's externall figurature into *Mountaines*, *Valleyes*, and *Plaines* is very naturall; because euery space or parcell of land in respect of the places neere or about it, must either rise higher, or fall lower, or at least must beare an equality; where the former is admitted, there must needs be *Mountaines* swelling higher then the ordinary leuell of the Earth; where the second is found, the ground is indented with *Valleyes* and *concavities*: where the third is to be seene, there must be *Plaines*. Here is to be noted that howsoeuer *Plaines*; absolutely considered, haue a sphaerickall surface for the most part, especially if the *Plaines* be large, because they concur as circular segments to make vp the *Sphaere* of the Earth; yet they may be called *Plaines*, because they so appeare to our sense, which in so short a distance, cannot perceiue the *Sphaerickall* figurature of the Earth; Some *Grammarians* here curiously distinguish between *mons* or a *Mountaine*, and *Collis* or a *Hillock*, which is a litle hill: & also betwixt *Vallis*, which they would haue to be a low parcell of ground betwixt two mountaines, and *Conualis* which is a lower space, only bounded on one part by a *mountaine*, which *Varro* would haue to be deriued from *Cavata vallis*; but these *Grammatical* scruples are of small vse to such as spend themselves on greater matters: because the ordinary & vsual manner of speech (euen amongst the vulgar) will shut out all mistakes in this kind; what deserues the study of a *Topographer* concerning this, shall be expressed in these *Theoremes*.

I. Mountaines, Valleyes, and Plaines were created in the Earth from the beginning, and few made by the violence of the Deluge.

It

It hath bin the opinion of some, aswell *Divines* as *Philosophers*, that the violence of the *Deluge* hath extraordinarily altered & defaced the Earth, being the chiefe cause of *Mountaines* & *Valleyes* therein: but this opinion is contradicted by many reasons: first out of the Text it selfe of *Genesis*, where it is said, that the water of the flood over-flowed by 15 Cubits the higest Mountaines: to which may be added the Testimony of *Damasceus*, who reports, that in the time of the *Deluge*, many resorted to a high mountaine of *Armenia*, called *Baris*, where they saued theselues which last clause although it expressly contradict the holy *Scriptures*, which speake but of Eight Persons that were saued: yet it is a sufficient testimony to proue that such Mountaines were before the Flood, & therefore not made by it: Secondly had there followed so great an alteration of the Earth, to cause *mountaines* as some imagine, then should not the same places after the flood retain their names, bounds, and descriptions, which they did before the flood; the contrary whereof we find, in that *Moses* writing of *Paradise*, & other places, about 850 yeares after the flood, was most exact in setting down the *Names*, *Limits*, & whole description of them, as though they had remained to be seene in his dayes. Thirdly, had the violence of the waters beene so great as to raise vp mountaines in the Earth, it would without doubt haue bin forceable enough to haue turned *Riuers*, and haue changed them from one place to another, cast downe & demolished the greatest Cities and buildings, throwne downe and ouerwhelmed all plants and vegetalls on the Earth, and (as it were) haue buried from all succeeding time, the memories of the former ages, so that little or nothing should appeare: but this may bee proued otherwise by sundry Instances: First that the the *Riuers* haue still remained the same, may appeare out of the place alleaged of *Genesis*, where *Moses* speaking of the site of *Paradise*, set downe all the rivers of it exactly, especially *Tygris* & *Euphrates*: out of the which we may easily gather in what *longitude* & *latitude* it flood: had any thing bin altered in the course of the rivers, it is likely *Moses* would haue specified:

fied it in this *Historie*, that after ages looking for these places, might not mistake or suspect the truth of his Relation: Secondly, that it hath not extinguished all *Buildings*, and ancient monuments of the fathers before the flood, may probably be conjectured by the testimony of *Iosephus* a writer of good credit, who affirmeth that he saw one of the pillars, erected by *Seth*; the second from *Adam*; which pillars were set vp aboue 1426 yeares before the flood, accompting *Seth* to be a hundred yeares old at the erection of them, and *Iosephus* himselfe to haue liued some 40 or 50 yeares after *Christ*; Now although we are not bound to credit all that he relates; yet may we trust him concerning such matters as happened in his time; and that this pillar was set vp by *Seth* was neuer yet called in question, but warranted by *antiquity*: the like is recorded by *Berosus* of the City of *Enoch*, that it was not demolished by the flood; but remained many yeares after, the ruines whereof as *Annian* in his commentary reports, were to be seene in his time, who liued in the time of *Ferdinand* and *Isabella* of *Castile*. It is also reported by *Pomponius Mela*, that the City of *Ioppa* was built before the flood, of which *Cepha* was King, whose name with his brother *Thimius* together with the grounds and principles of their religion, were found grauen vpon Altars of stone: All which are sufficient to proue the violence of the Waters, not to haue bin so great to demolish all *mountaines & monuments*; Moreouer it may be plainly proued out of the text, that the Waters suffered the plants and trees of the Earth to grow, and remaine as they did before; because it is said, that when *Noah* the second time sent out the *Dove*, she returned with an *olive* branch in her mouth, which no doubt she had plucked from the trees, after the trees were vncouered; for otherwise she might the first time haue found it floating on the Waters: a manifest proof that the trees were not torne vp by the roots, or turned toply turvy, but remained fixed in the Earth as they did before. Fourthly, had the water suffered this extreame violent motion, as whereby it might make many mountaines, I aske whence this motion should come? it could not be from the natural

naturall motion of the water, which is to moue downward; for what descent of waters can be in a *Sphericall* or round body, where no part is higher, or lower? That there was any wind to driue and enrage the Waters, is very vnlikely; because it is said, that God caused a wind to passe vpon the Earth, and the Waters ceased; so that there was no wind till the Waters sanke: Lastly, we may argue from a *small cause*, that this inæquality in the superficies of the Earth was before, the flood; because it is certaine that all things were in as good or better estate, then now with vs, and that the Earth was adorned with all varieties of creatures as well for *profit* as *delectation*. Now it is found by experience, that all commodities agree not to all places, but some are found in the mountaines, as all sorts of *mettalls* & *mineralls*, *Plants*, & *Vegetalls* for the most part prosper best in the *vallies* and *plaines*: Also that the mountaines serue for a shelter to guard the vallies from the rigor of *cold* and *wind*, both for the better conueniencie of mans life, and encrease offruits for the vse of man: Whence we may conclude, that it is farre more probable, that the great *Mountaines* were so created in the beginning, and not made by the flood; yet can we not deny, but that some small *Hilloeces* might be made by the flood, and afterward by the industrie of man, which haue raised great *fortresses*, & bulworks, which afterward decayed, were made great heapes of Earth (as we see many in this land) but this is of small note & not worthy consideration, in comparison of the great mountaines of the Earth whereof we especially treat.

2 *The perpendicular height of the highest mountaines seldome exceeds 10 furlongs.*

This proposition depends on the authority of *Erastosthenes* a famous *Mathematician*, who being emploied by his King, found out by *Dioptrick* Instruments the height of the highest mountaines, not to exceed the quantity aboue specified. *Cleomedes* extends this a litle farther, and would haue some mountaines to attaine the height of 15 furlongs, of which height he would haue an high rock in *Bactriana* called by

Strabo 11 libro *Sisimitra Petra*; But yet if we credit *Pliny* on *Dicaearchus* who measured the Mountain *Pelion* accōpted the highest, he found it not to exceed 1250 parts which make 10 furlongs: and *Solinus* relates the mountaines of *Thessaly* to be higher then else-where are to be found. But this opinion howsoever supported by the authority of the ancient and famous *Mathematicians*, hath bin called in quæstion as well by moderne, as ancient writers. Many matters are miraculously, or rather fabulously spoken of the Mountaine *Athos* in *Macedonia*, of *Cassius* in *Syria*, and another of the same name in *Arabia*, of the mountaine *Cautasus*, and others: which Histories notwithstanding are related by no meaner Authors then *Aristotle*, *Mela*, *Pliny*, and *Solinus*; yet it is not hard to imagine, that these Authors might be deceived in those times, either trusting to other mens relations, or wanting *Mathematicall* instruments, to search these matters: Of the Mountaine *Athos* it is much wondred at, that it should cast a shadow from *Macedonia* into the market-place of *Myrina* a towne of the Iland *Lemnos*, distant from *Athos* 86 miles: But this as our learned Countreman *M^r Hues* well obserues, can be no great argument of such a miraculous height; because the mountaine *Athos* situat East from *Lemnos* (as may be gathered from *Ptolomies* Tables) may without any great wonder cast a very long shadow, the *Sunne* either rising, or setting. Other matters are related of this mountaine *Athos* more strange then the former, to wit, that it should in high transcend the Region of the raine, and wind, which they would strive to confirme out of an old tradition; that the ashes heaped together on certaine Altars built on the top thereof were neuer blowne away, but remained in the same manner as they were left: to which may be added out of *Strabo*, that they who inhabit the top of this mountaine, can see the *Sunne* 3 houres before those who inhabit neere the sea: The like is reported by *Aristotle* of the Mountaine *Caucasus*, that for the extreame height, the top of it enjoyes the *Sun-beames* a third part of the night; Little lesse is spoken by *Pliny* and *Solinus* of the mountaine *Cassius* in *Sy-*

ria, and by *Pomponius Mela* of the mountaine *Cassius* in *Arabia*; But how fabulous and incredulous these things are, *Petrus Nonius* and other *Mathematicians* haue sufficiently demonstrated out of the grounds of Geometry; more absurd by farre seemes that, which *Eustathius* reports of *Hercules* pillars celebrated by *Dionysius Perieges*, for their admirable height; whereas they are found not to exceed 100 ells making one furlong; a height according to *Strabo* not exceeding the *Egyptian Pyramides*, and comming short of certaine *Indian* trees neare the Riuer *Hyarotes*, whose *Meridian* shadowes reach 5 furlongs; These errours in the ancient might seeme veniall, had they not bin seconded by latter writers: Of the Mountain *Tenariffe* in the *Canaries*, *Scaliger* is bold to report out of other mens relations, that it riseth in height about 15 leagues, which make 60 miles; but *Peetrus* more bold then he, would haue it 70 miles; Little lesse is spoken of *Pico* amongst the *Azoris Insula*, and the Mountaine *Andi* in *Pern*; But to confute these relations we will vse this argument; It is reported by the *Spanish* writers which haue spoken of this place, that the topps of these Mountaines scarce any one or two monethes in the yeare are free from snow: Now that snow should be ingendred about 60 or 70 miles about the ordinary plaine of the *Winter* or *Earth*, is against the iudgment of our best *Astronomers*; because, as they haue obserued out of *Eratoſthenes* measure, the heighest vapors seldome reach so farre, as 48 miles in height euery way from the Earth. This argument may as well serue to confute these ancient opinions before mentioned, had they not bin so fabulous, as scarce to deserue any solide confutation.

- 3 The ordinary height of the Land about the Sea in diuerſe places is more then the height of the highest Mountaines about the ordinary face of the Earth.

We haue probably shewed out of former grounds, that as the ordinary height of the Earth is answerable to the ordinary

nary depth of the Sea, so the *hilles* and *mountaines* in proportion answer to the *whirle-pooles* and extraordinary gulphes of the Sea: but it is to be imagined that the depth of the Sea in the maine Ocean, is farre more below the superficies of the Earth then those other *whirle-pooles* and *Holes* extend themselves below that depth. But to proue this by a more sensible Argument we will compare the one with the other, so farre forth as *Mathematicians* by experience haue guessed; for it is found by *Mathematick Instruments* (as we haue proued in the precedent Theoreme) that the highest *Mountaines* seldome or neuer mount vpward about ten furlongs, which is an *English mile*, and a *quarter*: but the hight of the Land in some places where appeare no such hills, is obserued to be much more: to proue which assertion, we can haue no fitter argument then the fresh *Springs* of Riuer; for it is manifest that all Riuer are higher at the *Spring* or fontaine, then at the place where they disburthen themselves into the sea. Now although water is apt to slide away at any Inequality, yet it is most probable that in greater riuer, especially where the waters fall oftentimes with violence (as at the *Cataracts* of Nile) much inequality must be granted in the *Declivity* of the ground: supposing yet the water for euery mile to gaine two foot in the Declivity of the ground, we shal find the hight very neere to equalize the hight of the highest *mountaines*; although 2 foot in a mile is farre lesse then can be imagined in so great a Riuer: The Riuer which I take for an example shall be *Nilus*, which we shall obserue to runne about 50 Degrees from South to North, which resolued into miles will make 3000: accompting for euery mile 2 foot, we shall haue 6000 foot, which will be neare these 10 furlongs, being a mile and $\frac{1}{3}$ parts: then allowing for these mighty *Cataracts* where the water falls with so great a violence, we must reckon a number of feet far greater then this measure; for euery mile must the hight of land aboue the sea be much more then of the *mountaines*.

4 *Mountainous Regions are commonly colder then*

then other plaine Countries.

This Proposition is not absolutely to be understood without a limitation: for some *plaine* Countries neare the *Arcticke* Pole, may be colder then some *hilly* Regions neare the *Aequatour*, in regard of other concurrent causes: but here we speake (as the *Logicians* vse) *cæteris paribus*; comparing two places either together like, or not much different, or at least in our understanding, abstracting them from the mixture of all other considerations: that this Theoreme is worthy credite, diuerse reasons stand in readines to iustifie: the first may be drawne from the cause of *heat* in Inferiour Bodies, which is the reflexion of the *Sunne-beames*. Now that this reflexion is of more strength and validity in *plaine* then in *hilly* and *mountainous* Countries, is evident: first, because (as the *Optickes* teach) the *rayes* are more ioyned and combined in a *plaine*, then in a *convex* superficies; for howsoever the whole Earth be of it selfe *Sphericall*, yet the *convexity* being not sensible, by reason of the vastnes of the Circle, whereby the convexity is made lesse, it may *optically* be called a *plaine* superficies: Secondly, it is taught in the *Optickes*, that a reflexion is of more validity in an *aquall*, then in an *vneuen* & ragged superficies, such as is found in *Mountaines* and *vneuen* places. A second reason why *mountainous* Regions should exceed others in cold, may be the vicinity of them to the middle Region of the *Aire*; for of all the Regions (if we belieue *Aristotle*) the *middle* is the *coldest*, as being more separate from the *Sunne* the fountaine of *heat*, and the higher Region, farther off from the reflexion of the *Sunne-beames*, then the lower: Now sith the parts of the Earth are affected with the quality of the *Aire*, it must needs stand with reason, that the more it shall approach to the *middle Region*, the more it must partake of it's quality. Thirdly, that this is consonant to observation, reasons are vrged by experience of all Travellers, who report the *Tops* of *Mountaines* euen in the midst of Summer to be couered over with snow, although situate vnder or neare the *Aequinoctiall* Circle: Of this nature are the *Alpes* in *Italy*, the *Mountaines*

of the *Moone* in *Africke*, *Andi* in *Peru*, and *Tenariffe* in the *Canaries*. That *snow* should be an effect of *cold*, I need not labour to confirme. A fourth reason may be drawne from other effects of *cold*, or *heat*; for it is daily proued by experience, that such diseases as chiefly follow *heat*, especially the *Pestilence* in *Egypt*, and such *plaine Countries*, are wonderful prævalent, whereas *hilly* and *rockie Countries* by the benefit of Nature stand in litle feare of such Inconueniences. Lastly, no greater argument can be drawne, then from the disposition of such men as inhabite such *hilly Regions*, who haue all the Symptomes of *externall cold*, and *internall heat*: In-
 somuch as *Bodin* seemes to make a Harmony and Con-
 consent betwixt the *Northerne* man and the *Mountainist*; the
Southerne man & such as inhabite *plaine countries*, ascribing to
 the former *externall cold*, and *internall heate*: to the later *ex-*
ternall heate, and *internall cold*. How farre this compari-
 son will hold, we shall haue more occasion to discusse hereaf-
 ter, when we come to the consideration of the Inhabitants.

5 *Mountaines since the beginning of the world
 haue still decreased in their quantity, and so
 will continually decrease vntill the end.*

This obseruation *Blaucanus*, I know not how truly, ascribes
 to his owne Invention: but to what Author soeuer we owe
 it, we must needs acknowledge a pleasant speculation, ground-
 ed on good reason. This Theoreme to demonstrate the bet-
 ter, we will first lay these grounds oftentimes before-menti-
 oned. First (as appears by testimony of holy Scripture) the
 figure of the Earth was in the beginning more perfectly
Sphericall, ouerwhelmed euery-where with the Waters. 2^{ly}
 That a separation was made by translocation of the parts of
 the Earth, in such manner as some places admitting of conca-
 vities, became the receptacle of the waters, other places where-
 on these parts of the Earth were heaped together, were made
 mountainous. 3 Hence will follow, that the Earth thus swell-
 ing y^e in high mountaines, is out of his naturall site and posi-
 tion:

tion: & therefore according to the law of Nature, will endeavour by litle and litle to returne to her former state and condition. Now thar the Earth hath sensibly suffered such a change since the beginning, it is easie to shew out of experiments: the causes we shall find to be the *water*, as well of the *Rain* as *Riuers*, which we shall demonstrate by these Reasons: 1 We see *Riuers* by litle and litle continually to fret and eat out the feet of *mountains*, whence the parts thus fretted through, by continuall falling downe weare out the mountaines, and fill vp the lower places in the valleyes, making the one to encrease, as the other to decrease, & the whole Earth to approach nearer to a *Sphaerickall* figure then before; which seemes to be warrantted by a place in *Iob* 14, where he saith to God; *The mountaine falling, commeth to nought, & the rocke is removed out of his place. The waters weare the stones, thou wastest away the things which grow out of the dust of the earth.* From these Riuers in the valleyes continually eating through the parts of the Earth, at the secte of mountaines are caused those slow but great Ruines called *Labina, à lambends*, by which sometimes whole Townes and Villages haue bin cast into the next great Riuier. 2 To proue thar Raine water challengeth a part in this diminution of mountains, we may shew by the like experience: we see plainly that Raine-water daily washes downe from the Toppes of mountaines some parts of the Earth; whence it comes to passe that the highest mountaines are harder and more rocky then others, as being more able to resist this violence of the water. Hence also it happens thar old buildngs being erected in the sides of mountaine, haue their foundations after a time vncovered, and are much subiect to Ruines: an instance whereof may be giuen out of the *Romane Capitoll*, whose foundation (according to the relation of *George Agricola*) appeares now plainly about the ground, which without question was heretofore deepe rooted in the Earth. In Plaines and valleyes we find all things to happen contrary wise, to wit, that ali places in regard of their superficies are raised much higher then they were in times past. The reason whereof may easly be giuen out of the great quantity of the Earth, carried by the washing of

of the Raine from the Tops of mountaines into the valleys: whence we may perceiue old houses, heretofore fairely built, to be now almost buried vnder ground, and their windowes heretofore set at a reasonable hight, now growne euen with the pauement: so some write of the Triumphall Arch of *Septimius* at the foot of the Capitol Mountaine in *Rome*, now almost couered with Earth, insomuch as they are inforced to ascend down into it by as many staires as formerly they were vsed to ascend. In like sort we see in old Monasteries & Religious houses, their lower roomes, windowes, & doores, very far couched vnder ground, of which great incōuenience we cannot suspect the Architects iudgment, but rather our fore-mentioned cause: from this burying of parts of some houses vnder ground, it may be gathered, that the farther they are vnder ground, so much ancienter they are: as we may obserue heere with vs in *Oxford*, that our most ancient Colledges haue the windowes of their lower roomes, somewhere altogether choaked vp with Earth without, or at least halfe way, in so much as the floore within, is found to be farre inferiour in height to the street without: This is also confirmed by Architects, who in digging vp old foundations, before they came to firme ground whereon to erect a building, are enforced first to remoue away the *Rubbish* or (as they terme it) the *Made-ground*, wherein oftentimes they find *Wood*, *Iron-Instruments*, *old coine*, with diuers other Trash of this Nature. An instance we haue in some of the lower places in *Somersetshire*, where some vpon occasion digging the Earth somewhat deep, haue found great *Oakes* turned topsy turvy with their Roots vpwards. To coniecture with some, that this was caused by *Noah's Floud*, seemes to be very improbable: 1 because as we haue formerly shewed in this Chapter, the Water in the *Deluge* could not haue so violent a motion to procure such an alteration in the parts of the Earth. 2 It cannot so well be imagined how such Trees should remaine so long a time without putrefaction: wherefore we cannot well cast it on any other cause, then the addition of the earthly parts, brought by raine from the mountaines into the valleys: and

so

so by some *Land-flood* which partakes much of slimy and earthly matter dispersed abroad vpon the land about. Now on the contrary part we find in few places of mountaines such *made-ground* which hath before bin moued. This will also appeare out of the industry of our *Low-countrimen*, who by baying vp the Riuers into certaine Artificiall Channels, the ground about hath bin much raised: where on the contrary side the forcing of the water into higher places, oftentimes is found to fret through the Earth, and make it lower. What we haue spoken of the effects of *Riuers* and *Raine* in diminishing the greatnes of the *mountaines* and exalting of the vallyes, we may in some sort find in the sea. For the bottome of the Sea being lower then the Earth, & many great Riuers continually running from the Earth into it; it is manifest that there is carried in their current a great quantity of earth, insomuch as by the heaping of sand and earthy rubbish, the mouthes of great Riuers are in time choaked vp, and commodious hauens spoyled & remoued farther into the land: of which alternall transmutation of the Sea & Land we shall speake hereafter: & for present instance need to goe no farther then diuerse Townes in *Devon*, which (according to the Relation of ancient men) haue heretofore bin faire *hauens*, able to receiue great ships, to which notwithstanding at this time a small boat cannot arriue except in a full Tide. The like whereof is reported by *Aristotle*,¹ of a place in *Egypt* called *Delta*, made by the heaping vp of sand & slime, brought by *Nilus* from the *Ethiopian* mountains.² of *Ammania Regio*, which in times past being Sea, through the slime conuayed in the Riuers, became afterwards as a standing poole, which in proceffe of time waxed dry, and ioyned it selfe to the Continent.³ Of *Maotic Palus*, that the dry land environing it round, is so much encreased, that ships of that burthen cannot arriue, which could in times past within 60 yeares before; which is also in some sort testified by *Polybius*.⁴ The like is related of *Bosphorus Thracius*, and many other places recorded by *Pliny*, of which we shall speake hereafter. From these obseruations *Blancanus* would inferre these consectaries: 1 That the Earth was not from the

Maotic.

Lib. 4.

beginning endowed with mountaines: 2 That it should not so continue till the end of the world ; and vnlesse the Fire (whereof the Scripture speakes) should prevent it, the who'e Earth should in the end be ouer-whelmed with waters, as in the beginning, and so be made void of habitation: but on such coniectures I dare not too boldly venture, being speculations built on no sufficient grounds : All which can hence warrantably be collected is expresse in our former Theoreme.

2 Of the *Figuration* of Countries in *Mountaines, Vallyes, and Plaines*, we haue spoken: It is requisite here we speake somewhat of *Woods and Champian Countries*.

3 A *Wood* is a Region or space of Land beset with trees. A *Champion* Region is a space of Land either altogether void, or scarce furnished with trees.

Some Criticks here curiously distinguish in Latine, betwixt *Sylua*, *Lucus*, & *Nemus*: by *Sylua* vnderstanding a space beset with trees, ordained to be cut downe; but *Lucus* was a place where trees were not ordained to be cut downe, but reserved sacred: For in such groues they did anciently vse to offer sacrifice, as may appeare by diuerse places out of the *Old Testament*, where the Heathenish manner of worshipping was forbidden, and sometimes reprobud in the Kings of *Iuda* and *Israel*: That which the Latines call *Nemus*, is a *Groue* or *Wood* ordained onely for pleasure and recreation: but the discussing of these businesses rather belong to a *Grammarians* then a *Geographer*; who takes little notice but of those matters which most principally and remarkeably belong to any Region; wherefore omitting other curiosities, we haue distinguished onely betwene a *woody* and a *champion* Country; whereof (as we haue defined) one is beset with a multitude of trees; the other with few or none. What concerns a *Geographer*.

pher to obserue in those matters, shall generally be comprised in this Theorema.

I *Woods in these dayes are not so frequent, nor so great as in ancient times.*

We cannot imagine otherwise then that the Earth soone vpon the flood, bearing in her wombe the seeds of all vegetables, being inwardly moistned, and outwardly comforted with Heat, should presently abound with plants of all sorts; insomuch as in a short time each thing propagating it selfe by communication of his own seeds, the whole Earth was overgrowne as one forest: but afterwards as man began to spread and multiply on the face of the Earth, these Woods and Thickets began to suffer chastisement vnder the hand of laborious husbandry: For first to open a passage from one place vnto another, and that some parcels of ground should as pastures be diuided from *woody acres*, it was necessary that this great plenty of trees should suffer a decrease: yet little had this bin noted in so vast a store, had not the invention of building of houses by little & little turned great forests into Cities; which for the most part owed not only their first originall, but also their daily reparation to Trees and Timber: but aboue all the greatest deuourer of *woods* and *forests* is *fire*, an element fed and nourished almost of no other matter. For to let passe the ordinary vse of *fire* in euery house and family, which in so infinite a multitude of people, in so many yeares since the Flood, must require an extraordinary proportion of wood and fuell, how many Arts haue bin since invented, depending only vpon this Element? we will goe no farther then the Art of *Liquefaction*, *fining* of gold and other mettals, found out in the bowels of the Earth, wherein the couetousnes of men hath bin as vn-satiable as the fire. To this which we haue said, may probably be opposed two things: first the power and inclination of euery Creature to multiply and propagate it selfe. Secondly, the industry of mankind in seconding that inclination: Whence it may be conjectured that great woods should by durance increase to a greater quantity: for the former, no man

will deny, but that plants and trees left to themselves, will commonly propagate their kind: neuerthelesse it cannot prevaile so much as the other, which procure the decrease: first because the Earth being dryer now, then soone vpon the Flood, cannot so much further the growth of vegetals as then it did: Secondly, because (as we haue said) this growth in a populous Country, cannot be so great as the diminution, since few or no houses can want so necessary an Element as fire. To the second we answere that man's industry hath done somewhat in plantation of groues, and such like: but how litle is this in comparison of the huge and vast Forrests in time by man wasted and consumed. We shall read of *Germany*, that in the time of *Cesar* it seemed a wilde Country, having many great woods and Forrests, but few Cities; but now the case being altered, we shall find the Cities both in number and greatness increased, and the Woods diminished. Two instances may suffice, the one of the Forrest of *Ardenna* in *Lutzenburg*, accounted in *Cesar's* time 500 miles ouer, now scarce 50. The other of *Sylva Hyrcinia*, which heretofore (if we beleue Histories) reached so farre as a man could trauaile in 60 dayes; but now is made the onely limit or bound dividing *Bohemia* from the rest of *Germany*. The like may be obserued almost of euery other Country reduced to ciuility.

2 Places moderately situated towards the north or south Pole abound more in woods then neere the *Æquatour*.


This situation we vnderstand to comprehend almost all the temperat Zone, reaching either way so farre as 60 degrees or there about. The demonstration of this Theoreme depends of these two sements of all plants, Heat & Moisture; both which concur, not only to the abundance and fertility, but also to the greatness of all plants; for it is most certaine that wheresoever these two vitall succours are wanting or deficient, there must be a great scarcity of trees, fruits, herbage, & such like: This is the cause why the Regions farre North neere about

Howe God greiveth y peace all the

about the Pole, beyond 60 degrees, haue not onely scarcity of trees, but haue them such as are, of a farre smaller quantity then other Regions, lying more temperate: For the inter-nall & naturall heat is almost extinguished, with the extremity of cold, and the moisture (as it were) dried vp by the frosty disposition of the Region. To this cause may we ascribe, that which Geographers haue deliuered concerning *Islands*, that for want of *Timber* they couer their houses with *fish bones*, digging out houses in the sides of Rockes and mountaines. Moreouer that the meere defect of moisture may cause a scarcity of growth, may be proved by many places: 1 because *temperate* Regions, which are *mountainous* and lying higher, produce trees of small length; *Bodm* testifies as a thing very remarkable, that he hath obserued oakes in *France* not exceeding 3 or 4 feet. But this is no great wonder with vs in *England*: sith in the dry and barren plaines about *Salisbury* there are many examples not much different: All which, we can ascribe to no other cause then the want of moisture. On the other side as great or greater a defect of *heat & moisture*, is found neere the *Aequator*, by reason of the externall *heat* of the *Sunne*; which in all plants and vegetalls, not only evaporates the moisture, and by consequence causeth *drowth*; but by the extraction of Internall *heat*, leaueth a greater cold behind, correspondent to that humour in a man, which we call *Melancholy* and *choler-adust*: But this extremity of heat causing this defect of internall heat & moisture, we place not directly vnder the *Aequinoctiall*; because we haue shewed it to be more temperat: but rather vnder the *Tropicks*, which by experience are found scorched with great heat. How subiect these places vnder the *Tropicks* are to this sterility, we need goe no farther then *Libia* and *Numidia* to confirme; Places by the report of trauailers, indigent not only of *woods* and *trees*, but almost of all virall succours. Whereas the *woods & forrests* dispersed almost in euery region of *Europe*, and the more temperat parts of *Asia*, are celebrated of all writers. Yet whereas we haue defined the cheifest places for the growth of *woods* to be toward the North, so farre as 60 de-

grees or there abouts; we cannot warrant this as an absolute generall observation; because some places lying very low, & subiect to much moisture, though situat more Southerly, may enioy this proportion, as we haue formerly shewed of *trees* neare the River *Hiarotis* recorded by *Strabo*, to haue their noone shadowes of 5 furlongs, as also of certaine trees in *America* neere *Rio Negro*, wherein (as *Peter Martyr* writes) a King dwelt with all his family. But these places howsoever situat towards the *South* are (as *Geographers* deliuer vnto vs) most times of the yeare overwhelmed with Water, consisting all of *marish grounds*: yet these few instances drawne from the particular disposition of the Earth it selfe, cannot much impeach our proposition, which takes notice only of the situation of the Earth, in respect of the cardinall points of *North* and *South*, compared with the heauens.

CHAP. XI.

- 1 itherto haue we treated of the *Absolute* adjuncts of the land, we are now to speak of the *Relative*, which imply a respect of the *land* to the *sea*.
- 2 From this Termination of the land with the sea, there ariseth a two fold distinction: The first is of the land into *Continent* and *Ilands*.
- 3 A *Continent* is a great quantity of land consisting of many kingdomes and Regions, not divided by Water, the one from the other:

other: An *Iland* is a parcell of land compassed round with the sea.

An *Iland* is called in Latin *Insula*, *quasi in salo*; because it stands in the sea; some would haue it in *English* termed an *Iland*, as it were, *Eye of the land*: But this derivation seemes affected & not naturall: it might seeme more naturally to be deriued from the *French* *L' Isle*. But we will not dispute of the name: It is enough to vnderstand, that an *Iland* is a portion of the habitable Earth, every where environed with the sea, or at least with some great Riuer: but this last sense seemes more improper then the other; yet oftentimes vsed, as *Meroe* in *Africa* an *Iland* of *Nilus*, and the *Iland* of *Eely* in *England*. To this is opposed the *Continent*, as that land, which being not divided and separated by the sea, contains in it many empires and kingdomes, as *Europe*, *Asia*, *Africk*, *America*; all which, as farre as we can yet gather, are vnited and ioyned together, in one continuateland; *Strabo* affirms out of this in his 1. booke and first chapter of *Geographie*, that the whole Earth is one *Iland*; sith all these knowae parts of the Earth, are compassed about with the sea on euery side: But this opinion cannot stand with reason, or moderne obseruation: First because this acception is too large; forasmuch as an *Iland* is properly taken for a smaller part, divided from the rest of the land, and opposed to the *continent*; whereas if this sense were admitted, the distinction of land into *Continent* and *Iland* would haue no place, or at least the same in a diuerse respect, might be called a *continent* and an *Iland*. But it is plaine that *Ilands* were alwayes opposed to the *continent*, to which, although separat by Water, they were supposed to belong, as to *Europe*, *Asia*, *Africk*, *America*, or *Maggellanica*, or some other as *Geographers* haue reduced them. Secondly, because it was a cold conjecture to thinke the whole world to consist only of those parts, found out in *Strabo's* times: For besides the two parts of *America* since that time discovered by *Columbus*, another great portion is since that time found out in the south, by the conjecture of *Ferdinando de Quir*,

Quæ comming neere the quantity of *Europe, Asia, & Africa*. Which howsoeuer it be round enuironed with sea, and therefore might seeme an Iland, yet in respect of the greatnes of it, and the many regions and kingdomes it containes, it may well be reputed a continent: To which many lesser Ilands belong.

- I. *It is probable that Ilands were not from the first creation, but were made afterwards either by the vniuersall deluge, or some other violence of the Water.*

It hath bin the opinion of diuerse learned men, that *Ilands* were not only before the *Flood*, but from the first creation of the world: because they seeme no lesse to make for the ornament of the Earth, then diuers Lakes and Riuers dispersed on the Land. But this argument seemes very weake: first because a greater ornament seemes to consist in vniformity then confusion; besides, the ornament must not be measured by our phantasie, but God's Almighty pleasure and will expressed in his own workmanship: and that he created Ilands in the beginning, is the thing in question. That Ilands were not from the Creation, many probable reasons are alleaged: First from the words in the 1 of *Genesis*: *Dixit vero Deus, congregentur aqua quæ sub cælo sunt, in locum unum, & appareat arida: & factum est ita; & vocauit Deus aridam, terram; congregatio- nesq; Aquarum appellauit maria.* By which may be collected, that the waters were gathered together in their own place, by themselues, and therefore had no such intercourse betwixt Land and Land as now they haue, admitting Ilands: wherefore it is more probable, that such Ilands as now appeare were either caused by that *Vniuersall Deluge* of *Noah*, or by some other Accident: for it is most certaine that the Sea on the Land some-where gaines, and other-where in recompence of it, it loseth againe: as may appeare by the 14 of *Genesis*; where it is said of the comming together of certaine Kings: *Hi omnes conuenerunt in uallem Syluestrem, quæ nunc est mare*

salis

salis: out of which it is euident that that parcell of ground which was a woody place in the time of *Abraham*, was before the time of *Moses* become the *Salt Sea*. Many examples of the like are giuen vs by *Pliny* in his *Naturall History*, which we shall haue occasion to vrge hereafter: And therefore it is no hard thing to belieue, that since the first beginning of the world all Ilands might be produced in this sort. Another argument by which they would establish this opinion, is that we see almost all Ilands of the Earth not onely inhabited of mankind, but also furnished with diuerse kindes of Beasts, some tame, some wilde, some wholesome, some venomous, some vsfull, some altogether vnprofitable. Now it seemes very vnlikely that men being in elder times, and now also in most places of the Earth, altogether vnskillfull in the Art of Navigation, should venture so farre on the maine Ocean, to people Countries so far distant; sith at this day, wherein Navigation is arriued at a great perfection, hauing the helps both of the *Chart* and *Compassse*, altogether vnknowne vnto the ancients, we see most Nations very scrupulous in searching out sarreremote Countryes. But admit this were ouercome by man's Industrie, which no doubt is much increased by Necessity; yet cannot it be very probable, that so many sundry kindes of beasts should in this sort be transported: for howsoeuer we conjecture concerning such beasts as necessarily serue for man's sustenance; yet seemes it hard to thinke that man should be so improuident and envious to the place of his own Habitation as to transport ravenous, venomous, vnwholesome, & vnprofitable creatures: for by no other meanes but by transportation can such beasts be imagined to be brought into Ilands: For the first originall of all creatures in the Creation was in or neare *Paradise*, which we shall proue to haue bin in the Continent of *Asia*; the second *Seminary* was in the *Arke*, which by the testimony of the Scriptures was first disburthened in the same Continent. How from hence they should spread themselues into Ilands, is the doubt. Impossible it seemes they should swimme so farre; for what Creature will venture it selfe on the maine Ocean being by a naturall

instinct fearefull of death, and carefull of his own preservation: Whence it is more likely to imagine, that these parcels of land being first furnished with such creatures, were afterwards by the violence of the flood, or some other like Accident, torne off from the maine Continent, retaining still such Creatures as it had before. But here *S. Augustine* seemes to avoide this Argument two wayes: It is not (saith he) incredible, that wild and savage beasts might be transported from one Country to another by Sea: either by *Men* for the delight of Hunting; or else by the helpe of *Angels* by God's Commandement, or at least permission. This answer seemes very probable aswell for it selfe, supposing nothing impossible to Almighty God, as also for the authority of the *Authour*. But with all reverence to the *Authour*, whom all the *Christian* Churches are bound to honour, this assertion is not so strongly fortified to enforce assent. And first it is not very likely that pleasure with men should so farre overthrow the generall weale and profit, as to transport so many ravenous and hurtfull beasts, for meere hunting sports and recreation. Secondly, the chase of some, as *Lions*, *Leopards*, and such like, hath more danger in it then sport or delight; and if so be these were conveyed over Sea for such ends, yet it is very probable, they would keepe them rather close and imprisoned to serve occasion, then to let them loose & free for farther propagation. Finally whereas he ascribes the transportation of them to the ministry of Angels; no man can deny but this may be possible; because by the permission of Almighty God they might effect greater matters. Yet seemes this not so likely as the other, because we find that in the generall preservation of all creatures in the Arke, he used the ordinary helpe of Naturall meanes, although directed and assisted by a divine power: And if God effected greater matters in this sort, why may we not believe it of things of lesser moment and necessity? But of this we have spoken before. Another reason for our opinion that Islands were not before the flood, or at least from the Creation, is urged by *Versteegan* a late Writer in this manner: There is nothing broken (saith he) that hath not bin whole:

whole; which he sets downe as an infallible principle : for howbeit Nature doth sometimes against her own intent commit some errors, insomuch as the things formed haue either too much, or too little ; yet bringeth she forth nothing broken or disseuered; but such as it is, it is alwayes whole and not broken, except afterwards by some accident. And if *Nature*, the hand-maide of God, neuer misseth this perfection, much more ought we to belieue that God the Father of *Nature* in the first Creation left no part thereof broken and vnperfect. But every man may see by ordinary obseruation, that the *Cliffs* and *banks* of the Sea (as not being by God in the creation so formed) seeme not onely seuered and broken, but (as it were) cut *streight* and *steep* downe from the top to the bottom, not stooping or declining by degrees; as we see in *Inland Hills* in their descent vnto the vallyes. The forceable breach of the land (as we pretend) by the Sea fretting through some narrow place, seemes the more to be confirmed in that we find it not steep towards the Land, where the Land declines by a sloping descent as in other places; but rather towards the Sea in such sort, as both the sides of a narrow and streite Sea oftentimes in the nature of the soile, and conformity of figure, seeme to answer one the other, only shewing the want of substance betwixt them which is lost. It may hence be objected that many other hills and rocky places of Inland Countryes, seeme in like manner as broken & steep downe as these *cliffs* bounding the Ocean; as also that the *cliffs* towards the Sea are broken higher vp then any wayes the Sea could be imagined to ascend. To this we answer, first that *rocks* on the dry land many times seeme broken, when indeed they are not, being by Nature fashioned craggie and vneuen: Secondly, whereas *Hills* in Inland countries seeme broken, this might proceede heretofore by *Earthquakes* which haue oftentimes bin obserued to produce such effects, as it hath lately beene knowne to doe in a Town called *Pleurs* in the *Grisons* Countrey neare the *Alpes*: and for the appearance of such breaches in the tops of cliffs about the ascent of the waters, it might be caused by the violence of the Sea waues, fretting and eating

out the sides of them beneath the bottome; whence it happens that the higher part for want of vnder-propping must needes fall and breake off from the other. This Argument of our said Author is by him back't with another, drawne from the name of a *cliffe*, which in our ancient language is drawne from cleaving or breaking off: which appellation is neuer giuen to our Inland Hills, but only to such as terminate & compassse in the Sea. These reasons make the matter seeme probable; yet condemne I not the other as absurd, because it may probably be defended, and backt with the authority of many graue Authors.

4 A second Distinction ariseth out of the termination of the Land with the Sea: For either it is *vniforme* or *various*.

5 An vniforme termination I call that which without any notable difference inclines more to euennesse and Regularity.

It is manifest that the Sea-waues working on the Land *violently*, and not *naturally*, seldome or neuer so bound and compassse the Land, as to reduce it to a regular and perfect figure. But yet because in some places it comes somewhat neere to such a figure, somewhere it is very farre off; we thought it fit to insert this distinction. This inclination to a Regular figure is some-where square, consisting of *Right-lines*, some-where *circular*; an example of the former we haue in *Spain*, which on the *North side*, & the *West* is bounded more streightly, comming neere a *right-line*: of the other in *Africke*, whose *North-West* side from the *Mediterranean* streits to *Guinea* seemes in some sort circular.

6 A *various* Termination is that wherein the bounds are crooked, and as it were indented with creekes and turnings. Heere three things

things are remarkeable. 1. *Peninsula*, *Isthmus*, and *Promontorium*.

- 7 A *Peninsula* is a part of land euery where environed with the sea, excepting in one part, where it is knit vnto the maine land: An *Isthmus* is a narrow land betwixt two seas: A *Promontorie* is a high mountaine bending it selfe into the sea: the head whereof is called a *Cape*.

These three are remarkeable accidents growing out of the Termination of the land with the sea, and belonging as well to continents as Ilands. The first we call *Peninsula*, *quasi penè Insula*, termed of the *Gracians Chersonesus*, although I find this name oftner giuen to the *Isthmus* then the *Peninsula*. Amongst the *Peninsulas* the most famous are *Africa*, *Scandia*, *Taurica Chersonesus*, *Peloponnesus*, and *America Peruviana*. That litle parcell of land which joynes this *Peninsula* with the maine land, we call an *Isthmus*, which is a narrow neck of land betwixt two seas, ioyning two Continents; such as are *Isthmus Corinthiacus* and *Isthmus Cimbricus*: more famous are those two narrow lands, whereof the one lieth betwixt *Peruana*, and *Mexico* in *America*, the other diuiding *Africk* from *Asia*. A *Promontorie* is a great mountaine stretching it selfe farre into the sea: whose extremitie is called a *Cape* or head, of which the most remarkeable are the *Cape* of good hope in *Africk*, 2. The *Cape* of St. Vincent in *Portugall*, 3. The *Cape* of *Cornary* in *Asia*. 4. The *Cape de la victoria* in *America*. Our obseruation concerning this distinction shall be comprised in this Theoreme.

- 1 *Peninsulas* by the violence of the sea fretting through the *Isthmus*, haue oftentimes

bin turned into Ilands: and contrariwise
sometimes Peninsulas by diminution of the
sea made of Ilands.

This proposition is nothard to proue, if any credit ought
to be giuen to ancient writers: for it is commonly related,
that *Sicily* was heeretofore ioyned to *Italy*, *Cyprus* to *Syria*,
Eubœa, with *Bœotia*, *Besbicum* with *Bythinia*; all which at this
day are Ilands separated and diuided from the continent. The
like hath bin conjectured of our *Britanny*, which some ima-
gined heeretofore to haue bin ioyned with the continent of
France, about *Dover* and *Calais*: as may seeme probably to
be gathered out of the correspondency of the *Cliffs* (whereof
we haue spoken in this chapter before) the agreement of the
soile, the smallnes of the distance, and many more arguments
remembered by vs else-where. Also it hath bin obserued
on the otherside, that the sea in some places leauing his ancient
bounds, hath ioyned some Ilands to the land, making *Penin-
sulas* of Ilands. In this sort if we belieue antiquity was *Antissa*
ioyned to *Lesbos*, *Zepherium* to *Halicarnassus*, *Ethusa* to
Mindus, *Promiscon* to *Miletum*, *Narthacusa* to the *Pro-
montory of Parthenius*: In these antiquities it behoues euery
man to iudge without partiallity, according to reason, not al-
cribing too much to fabulous narrations, wherein those ages
did abound, neither yet shewing himselfe too incredulous:
For as much as we cannot charge these Authors with any ma-
nifest absurdity. The speciall and particular arguments by
which we should establish our assertion, we must according
to the rules of method referue to the speciall part, where we
shall treat of speciall countries.

C H A P. XII.

OF the perpetuall Accidents of the land, we haue spoken somewhat: it remains in this place we treat of the *casuall*.

- 2 The *casuall* I call such as happen not ordinarily at all times: such as are *Inundations* and *Earth-quakes*.
- 3 An *Inundation* is an ouerwhelming of the land by Water.

Howsoever it be certaine out of holy Scriptures, that God hath set the sea his certaine bounds and limits, which it cannot passe: yet the same God sometimes to shew his speciall judgment on some place or age, hath extraordinarily permitted the sea sometimes to breake his appointed limits, and inuade the Iurisdiction of the land. This we call a *deluge* or *Inundation*. The inundations which euer haue bin obserued on the Earth, are of two sorts, either *vniversall* or *particular*: An vniversall is that whereby the whole face of the Earth is couered with water; whereof we haue only two examples: The first was in the first creation of the world, when (as we read in the Scriptures) the whole face of the Earth was round inuoloped with Water, which couered the tops of the highest mountaines, till such time as God by a supernaturall hand, made a separation of the Waters from the dry land. But this is improperly call'd an *Inundation*, because, the same properly taken implies as much as an ouer-flowing of that which was dry land before: The second (as we read in *Gene-*

his happened in the time of *Noah*, when God for the sin of man, drowned the whole world, breaking open the cataraets of heauen, and loosing the springs of the deep. Particular inundations are such, as are not ouer the whole Earth, but in some particular places or regions; Such a deluge (according to *Genebrardus*) happened in the time of *Enos*, wherein a third part of the Earth was drowned. The like is spoken of *Ogyges* King of *Athens*, that in his time happened a very great Inundation, which drowned all the confines and coasts of *Attica* & *Achaia* euen to the *Agean* sea: In which time it was thought that *Buras* & *Helice* Cities of *Achaia*, were swallowed vp; whereof *Ouid* in his *Metamorphosis*, speakes thus.

*Si queras Helicen & Buran Achaidos vrbes
Inuenies sub aquis:*

Buras and *Helice* on *Achaian* ground

Are sought in vaine, but vnder seas are found.

As famous was the Inundation of *Thessaly* in *Deucalions* time mentioned not only by profane writers and Poets, but also by *St. Angustin*, *Ierom*, and *Eusebins*. which would haue it to happen in the time of *Cranus*, who next after *Cecrops* governed *Athens*. This inundation was exceeding great, extending it selfe not only ouer all *Thessaly* and the regions adioyning westward, but ouerwhelmed the greatest part of *Italy*. The same or other happening neere the same time, oppressed *Egypt*, if *Eusebins* may obtaine credit. Hence some would haue the people of *Italy* to haue bin called *Vmbri* (as *Pliny* & *Solinus* report) *quia ab imbris diluvij superfuissent*. But this *Etymologie* seemes too farre fetcht. There are also two other notable Inundations mentioned by ancient writers, which fell out in *Egypt* from the Riuer *Nilus*; whereof the first covered all the neither *Egypt*, which was subiect to *Promethens*, and hence (as *Natalis Comes* obserues) was the fable drawne of the vulture lighting on *Promethens* liver, afterwards slaine by *Hercules*. For (as *Diodorus Siculus* obserues) the Riuer *Nilus* for the swiftnes of his course was in ancient time called an *Eagle*. This Riuer afterwards did *Hercules* by his

his great skill and judgment streiten and bound, reducing it into narrow channels: whence some *Greek* Poëts turning *Hercules* labours into fables, fained that *Hercules* slew the *Eagle* which fed on *Prometheus* brest, meaning that he deliuered *Prometheus* out of that sorrow and losse which he and his people sustained by that *Inundation*. The second of these *Egyptian* floods happened about *Pharus* in *Egypt*, where *Alexander* the great built *Alexandria*. To these may be added many more of lesser moment, as well in ancient times as in our dayes: As that of *Belgia* in some parts mentioned before, on another occasion; and not many yeares since in some parts of *Somerseeshire* with vs in *Britanny*.

I No vniuersall *Inundation* of the *Earth* can be *Naturall*; *The other may depend on some Naturall causes.*

Of the causes of *Inundations* many disputes haue beene amongst *Naturall* Philosophers: some haue trusted so farre to Nature, that they haue ascribed not only particular *Inundations*, but that *vniuersall Deluge* in the time of *Noah* to second causes: of this opinion was *Henricus Meelensis* a Schollar of *Alberus Magnus*, who in his Commentaries vpon the great Coniunctions of *Albumazar*, obserued that before *Noah's* flood, chanced a conjunction of *Iupiter* and *Saturne* in the last degree of *Cancer*, against the constellation since termed *Argo's ship*: out of which he wou'd needes collect, that the flood of *Noah* might haue bin fore-showne; because *Cancer* is a watry signe, and the house of the *Moone* being mistress of the *Sea* and all moist bodies according to *Astrologie*: which opinion was afterwards confirmed by *Petrus de Alliaco*, who affirms in his Comment vpon *Genesis*, that although *Noah* did well know this flood by diuine Reuelation; yet this conjunction being so notable, he could not be ignorant of the causes thereof; for those were not only signes, but also apparant causes by vertue receiued from the first cause, which is God himselfe. Further to confirme this assertion he would haue *Moses* by the cataracts of *Heauen*, to haue meant the

the great & watry *conjunction* of the Planets. A reason whereof he seemes to alleage, because it is likely that God would shew some signe in the Heauens, by which all men might be warned to forsake their wicked courses. But notwithstanding this curious opinion, I rather cleaue to those which think this *deluge* to be meereley *supernaturall*, which I am induced to believe for diuers causes vrged by worthy writers. First, because this is set downe in *holy Scripture* for a chiefe token or marke of *Noah's* extraordinary faith and dependance vpon Gods promises: which had bin much diminished, and of small moment, had it any way bin grounded on the fore-sight of second causes. For this was no more then might haue bin discovered to the rest of the wicked worldlings, who no doubt would in some sort haue provided for their safety, had they receiued any firme perswasion of this dreadfull *deluge*. To which others add a second reason, that second causes of themselves, without any change or alteration, are not able to produce such an admirable effect as the drowning of the whole World: for it is not convenient (say they) that God the Author of Nature should so dispose and direct the second causes, that they might of themselves be able to invert the order of the Vniuerse, and ouerwhelme the whole Earth, which he gaue man for his habitation. But this reason is thought very weake, forasmuch as it seemeth to imply a new creation: The conceit of a new Creation is pronounced by a learned Countryman of ours, both *unlearned* and *foolish*: for whereas it is written (saith he) that the fountaines of the deepe were broken open, it cannot otherwise be vnderstood, then that the waters forsooke the very bowels of the Earth, and all whatsoever therein was dispersed made an eruption through the face of the Earth. Now if we compare the hight of the waters in this deluge aboue the highest mountaines, being onely 15 cubits, with the depth of the *semi-diameter* of the Earth to the Center, we shall not find it impossible, answering reason with reason, that all these waters dispersed vnder the Earth, should so far extend as to drown the whole Earth: for the *semi-diameter* of the Earth. (as *Astronomers* teach) is not aboue 3500 miles,

miles, wherein the waters contained and dispersed, may be sufficient for the hight of the greatest mountaines, which neuer attaine 30 miles vpright: whereas this distance of 30 miles is found in the depth of the Earth 116 times. Secondly the extension of the Ayre being exceeding great, it might please God to condensate and thicken a great part thereof, which might concurre to this Inundation. We willingly asseent to the worthy Authour, that this Inundation might be performed without any new creation: Notwithstanding we cannot hence collect that it was *Naturall*. But to compose the difference the better, and to shew how farre Nature had a hand in this admirable effect, we will thus distinguish; that an effect may be called *Naturall* two manner of wayes: First in regard of the causes themselves: secondly in respect of the *Direction* and *Application* of the causes. If we consider the meere *secondary* and *instrumentall* causes, we might call this effect *Naturall*, because it was partly performed by their helpe and concurrence. But if we consider the mutuall *application* and *coniunction* of these second causes together with the *first* cause, which extraordinarily set them a worke, we must needs acknowledge it to be *supernaturall*. For other particular Inundations in particular Regions we may more safely terme them *Naturall*, as directed and stirred vp by *second* causes, working no otherwise, then according to their own naturall disposition. Two causes concurring together, are here most notable, whereof the *first* is the great *coniunction* of watry *Planets* working on the water their proper subiect: the other the weakenes of the *bounds* and *banks* restraining the water, which by processe of time weare out and suffer breaches: both these causes sometimes concurring together, cause an Inundation: which assertion we may lawfully accept, but with this caution, that Almighty God working by second causes, neuerthelesse directs them oftentimes to *supernaturall* and *extraordinary* ends.

2. *Particular alterations haue happened to Bounds of Regions by Particular Inundations.*

Howsoever some inundation haue not continued long, but after a small time left the Earth to her own possession; yet others haue bin of such violence, as they haue bin found to haue fretted away, or added, and so altered the bounds and limits of places: which besides diuerse examples produced by vs, in our former chapter, *Aristotle* seemes to acknowledge in the 1 booke of his *Meteors*, the 14. Chapter, where he saith, that by such Accidents sometimes the Continent and firme land is turned into the Sea, and other-where the Sea hath resigned places to the Land: for sith the agitation or moving of the water depends ordinarily vpon the vertue of *heauenly* bodies, if it should happen that those *starres* should meet in coniunction, which are most forceable and effectuall for stirring vp of *tempests* and floods, the Sea is knowne to rage beyond measure, either leauing her ancient bounds, or else vtrping new. By this meanes (as we haue shewed in the former Chapter) some *Ilands* haue bin ioyned to the Land, & some *Peninsula's* separated from the Land, and made *Ilandse* some-where the Sea hath bin obserued for a great space to leaue the Land naked, as *Verslegan* coniectures of the most part of *Belgia*, which he sayes, was in ancient time couered with water; which besides many other arguments he labours to proue out of the multitude of *fish-shells*, and *fish-bones*, found euery-where farre vnder ground about *Holland*, and the coasts thereabouts, which being digged vp in such abundance, and from such depths, could not (saith he) proceed from any other cause then the Sea, which couered the whole Country, and strewed it with fishes. Lastly, that the Sea might seeme aswell to get as loose, she hath shewed her power in taking away and swallowing vp some Regions and Cities, which before were extant: Such fortune had *Pyrrha* and *Antista* about *Martia*, *Helice* and *Bura*: before mentioned in the *Corinthian* straites: some haue bin of opinion that the whole *Mediterranean* within *Hercules* pillars, was in time past *habitable land*, till it gaue way to the violence of the Seas invasion: But in this I credit nothing without farther ground. The like vncertainties are also related of the *Atlanticke Ilands*, greater

greater then all *Africa*, swallowed vp of the *Ocean*: which *Columbus* was said in a sort to haue discovered in the Sea, finding a great shallow fraught with weedes; where he supposed this great Island to haue stood. But I rather beleene that this *Atlantick* Island spoken of by *Plato*, was either a Poeticall fiction, as *Moore's Utopia* with vs, or at least the Continent of *America* perhaps in those dayes obscurely discovered, but the discovery lost againe to after ages.

3. Certaine Regions by reason of great Rivers are subiect to certaine Annuiersary Inundations; which commonly happen betwixt the Tropicks in the summer, without the Tropicks in the winter.

The former clause is proved by experience almost in all great Riuer in the world, which at some times of the yeare swell higher, ouerflowing their bankes, and drowning a part of the land about them. But this happens not alike in all places; for in Riuer included within the Tropickes, as *Nilus* & *Niger* in *Africa*; and *Oregliana* in *America* with others theie-about, this Annuiersary Inundation, is in the Summer; else-where it is commonly in the Winter. For the former these causes may be assigned; 1 The melting of the snow on the Tops of the great mountaines in those parts, which is greatest of all, when the Sun is neereft or verticall vnto them, which we are to accompt their Summer. 2 The daily Raines and showres such regions are subiect vnto; These shewres are much more frequent and greater when the Sunne is neereft their verticall point on iut: The reason whereof we haue formerly shewed to be this: That the Sun daily in those parts drawes vp more vapours, then he can dissipate and consume; Whence meeting with the cold of the middle Region of the *Aire* they are condensed in o drops, and so turned into Raine. For the later case in riuer situat without the Tropickes, commonly happens the contrary, to wit, that such Inundations happen rather in the winter then the Summer,

whereof these reasons may be rendred. 1 Because *Raine* and *showres* whereof such ouer-flowing are ingendred in those parts, are more frequent in winter then in the Summer. 2 whereas neere the *Aequator*, the *snow* is knowne to melt with the *sun* from the Tops of high mountaines, in other parts it seldome or neuer melts at all; (as may be thought) vnder the *Pole* or thereabouts; or else, if it melt, it happens, (as in the temperat Zones we see it doth) ofener by *raine*, then the heat of the *Sunne*.

4 Next are we to speake of *Earthquakes* : An *Earthquake* is a sensible motion and Shaking of the parts of the *Earth*.

Amongst other remarkeable affections of a place, which are not so ordinary, an *Earthquake* hath no small consideration, being oftentimes a meanes which God vseth to shew some great and extraordinary iudgment. But not to spend more on this subiect then may seeme meete for *Geography*, we will shew the *causes* & *kinds* of it, by which we may the sooner come to learne what *Regions* and places of the *Earth* are most subiect to this affection, which is necessary of a *Cosmographer* to be knowne. Concerning the *causes* of it, much dispute hath bin among *Philosophers*; some haue ridiculously affirmed, that the *Earth* is a liuing creature, & suppose with no lesse, if not greater absurdity, that the *Earth* being in good temper, doth rest and settle quietly according to her naturall disposition: From which temper if she be any way removed, as if she were sick, or pain'd in some part, she shakes & shivers. The relation of this opinion is a sufficient confutation. *Thales Milesius* would haue the *Earth* as a *shippe* to swimme on the *Waters*, which being sometimes as a vessell by tempests turned on one side too much, it takes a great quantity of water, which is the cause of *Earthquakes* : But this opinion is a poetickall fiction. Little more probable is the opinion of *Demo-ritus*, that the *Earth* drinking in *raine* water more then her caverns can well containe, the water reuera-

bera-

berated backe is cause of such a motion: But who can imagine that drops of raine falling into the Earth can be reverberated backe, with such violence to cause such an extraordinary motion of the Earth? *Anaximenes Milesius* was of opinion that the Earth her selfe was cause of her owne motion; for the parts of it being taken out (as it were) and broken, fall downe sometimes into a great depth, causing the vpper face of it to shake and tremble; to which opinion also *Seneca* seemes to subscribe in the 6. book of his naturall questions the 10 chapter; To which also accords the Philosophicall Poet *Lucretius* in these words.

*Terra superna tremit magnis concussa ruinis,
Subter ubi ingentes spe inncas subruit atas.
Quippe cadunt toti montes, magnosq; repente
Concussu late dispergunt inde Tremores,
Et merito; quoniam plaustis concussa tremiscunt
Tecta viam propter non magno pondere tota.*

The vpper Earth seiz'd with great ruines shakes,
When furrowed age her vast ribbes ouertakes.
For mountaines great fall downe, and with the blowe
The Tremblings are dispers'd to and fro.
Not without reason; when a small-siz'd waine
Makes houses neere the way to shake amaine.

This last opinion seemes to carry more shew of probability then the former; neither can any man deny, that sometimes the Earth in some parts, may shake by the breaking downe of some *subterranean* parts, whose suddain and violent motion may cause the rest being continuare to entertaine the like convulsion. But yet more generall seemes the opinion of *Aristotle* who would haue *Earthquakes* to proceed from a *spirit* or *vapour* included in the bowells of the Earth, as he testifies in the 2 of his *Meteours* the 7 chapter. For this vapour finding no way to passe out, is enforced to returne backe; and barred any passage out, seekes euery corner: and while it labours

hours to breake open some place for going forth, it makes a tumultuous motion, which is the *Earthquake*. Now least it should seeme improbable that so great a masse of Earth should be moued, and shaken, by so thinne & rarefied a body as is a fume or vapour; *Aristotle* in the same place shewes the admirable force of winds as well vpon the Aire, as on the bodies of liuing creatures: In the Aire; because experience shewes that being stirred vp by a windy vapour it sometimes is knowne to moue rockes from one place to another, to pluck vp trees and shrubbs by the rootes; and sometimes to throw down the strongest and most stately buildings: In mans body, because by the stirring vp and agitation of the spirits, which are the Instruments of virall and animall functions, sometimes one sick man can doe that, which cannot be performed by many stronger and abler men; as it hath bin tried sometimes, that a *Frantick* man hath broken very strong chaines, wherewith he hath bin bound; which many other men could not doe. Neither on the other side, can it seeme strange, that many and great exhalations, vapours, and spirits should be ingendred vnder the Earth; For asmuch as the Earth is heated many waies. Many waies may be specified whence such fumes should arise; as, first, from the sunne and starres; Secondly, from the subterranean fires hid in the bowells of the Earth; Thirdly, in the winter-time by an *Antiperistasis*, the heat collecting it selfe downward to the inner parts of the Earth, which was before in the outward parts of it: The argument by which *Aristotle* would confirme this opinion, is drawne as well from the time, as from the places, wherein Earthquakes vsually happen: from the time; because then most Earthquakes are obserued to be, when most exhalations are inclosed in the bowells of the Earth; to wit, in the *spring time* and the *Autumne*. From the places; because, for the most part *spongie & hollow Regions*, which may drink in a greater quantity of exhalations, are commonly most subiect vnto it: for although many exhalations are dayly inclosed in the womb of the Earth, yet Earthquakes fall but seldome; because the matter is seldome so strong and violent as to shake

the

the Earth: Wherefore some *Philosophers* haue expressed three principall wayes which make this *Earth-quake*: first when a great quantity of exhalations is suddenly ingendred, which for the greatnesse of it cannot be contained in so litle a space: for then being almost choked, it seekes a way to fly forth: Secondly, when the Earth is condensated by cold, and driues the exhalation from one place to another, which flying hither and thither, shakes and strikes the Earth: Thirdly when the exhalation, the cold compassing it round by an *Antiperistasis*, begets heat within it, and so is rarified: for so being vnable any longer to confine it selfe to it's former place, it breakes forth, and so shakes the Earth: We must here note by the way, that not onely exhalations are cause of the distemperature in the Earth, but also *subterranean fires* and *windes*: all which by some are iudged to be of equall force in this action: for the division of Earthquakes so farre forth as it concernes the difference of places, we must vnderstand, that it may be either *Vniuersall* or *particular*: An *vnuerfall* Earth-quake is that which shakes all the whole Earth in euery part, at least in the vpper face: whereof (I suppose) no *naturall* cause can be giuen, but the *immediate* and miraculous power of God: such an Earthquake happened at the time of our *Sauour's passion*, whereof *Didymus* a graue and ancient Writer left record. But that which is said to haue happened in the time of *Valentinian*, mentioned by *Orosius* in his 7 book of *Histories*, & 32 Chapter, is thought by graue Authours to be no *vnuerfall* Earthquake, howsoeuer for the large extent of it, it was thought to be generall. A *particular* Earthquake is that which is bounded in some one or more particular places, which for the causes before-alleged cannot be so farre extended, because the cavernes and convexities of the Earth, where such vapours & exhalations are contained, cannot be ordinarily so great as to extend to many kingdomes and Regions.

- 1 Regions extreame cold or extreame hot are not so subiect to Earth-quakes as places of a

Middle temper.

The reason is, because in places extreame cold, exhalations are not so soone ingendred, and in so great a quantity as in other parts: on the other side in places which are extreame hot, the exhalations which are bred, are soone consumed with excessse of heat: both which may be confirmed by Instances. It is obserued that in the cold *Northern* parts (as *Olaus Magnus* writes in his 10 booke and 13 Chapter) Earthquakes are very seldome or neuer: so it is obserued by *Pliny* in his 2 booke and 18 Chapter: and *Albertus Magnus* in his 3 booke of *Meteorours* tract. 2: That places which are very hot, as *Egypt*, are seldome troubled with this shaking of the Earth: whereas places betwixt both, which are seated in a more temperat climate, find it not so strange.

I Hollow and spongie places are more subject to Earth-quakes then solide and compacted soyles.


We must here vnderstand that hollow places are either such as 'ye open to the Aire, or are hollow onely vnder, and close vpward. The former sort are not at all subject to the molestation of *Earth quakes*, because, the *exhalations* fly out without impediment: but the latter being more apt to ingender and retaine such matter, must of necessity be more troubled. This is most plainly obserued in *Phrygia*, *Italia*, *Caria*, *Lydia*, wherein such motions are more frequent. To confirme this a litle further, we obserue that *hilly* and mountainous places, suffer this violence oftner then other parts; because there most commonly cavernes and concavities are more frequent then in plaine countryes. But here by the way may be objected, that *sandy* and *slimy* countryes are many times more free from Earthquakes then other places: an instance whereof was giuen before in *Egypt*, wherein neuer any *Earth quake* (as most Authors affirme) or at least but one (as *Seneca*) hath bin obserued. The reason may be giuen, that *sandy* places without any strife suffer the exhalations to disperse themselves: that

that slimy places want sufficient receptacles to entertaine them.

3 *Ilands are more often troubled with Earth-quakes then the Continent.*

This haue they found to be true in many *Ilands* of the *Mediterranean Sea*, and others also; chiefly in *Cyprus*, *Sicilia*, *Eubœa*, *Tyrus*, *Angria*, *Lippora*, and the *Molucco* *Ilands* betwixt the *East* and *West-Indies*. The cause some would haue to be the *Antiperistasis* or *circumstancy* of the waters, which is apt to engender greater store of exhalations in the Earth. But neuertheless that *Ilands* are more subiect to *Earth-quakes* then *Continents* I dare affirme no other wise then probable; because some places in the Continent seeme very much affected, especially in *Europe*, about other places, *Constantinople* and *Basilea*, if we credite authors which haue written of this matter; in *Asia*, *China*, and other Regions adjoining thereunto.

C H A P. XIII.

I  He *Naturall* Affections of the Land haue hitherto bin declared: We are in the next place to treat of the *Ciuilt*. Those we terme *Ciuilt* which concerne the *Inhabitants*.

2 An *Inhabitant* is a man dwelling in a certaine place.

The name of an *Inhabitant* (as we haue before noted) may be taken either generally for any liuing creature, residing in a certaine place, in which sense *Brute* beasts may be called *Inhabitants*; which signification is only *metaphoricall*; or else for a

Reasonable living creature, whose abode is settled in any place or Region, in which sense we here take it. The consideration of the *Inhabitants* we haue reserved for this last Treatise; following as well the methode of the first creation, as of *Moses* in the narration. For God proceeding in the first Creation according to the order of Generation, from the more vnperfect to the perfect, created not man before such time as he had furnished the Earth with all things agreeable and necessary for his vse; to which alludes the Poët in these Verses:

*Sanctius his animal mentisq; capaxius alta
Deerat adhuc, & quod dominari in cetera possit,
Natus homo est.*----

More sacred and of vnderstanding minde,
A creature wants to gouerne euery kinde;
So man begunne----

Of the *Nature, Proprieties, Dignities*, and other accidents of this principall creature, there wants no discovery; sith large volumes are stuffed with this theame, and euery man which knowes himselfe can prevent me in this subiect: I will here speake of him so far forth as he is an *Inhabitant* or dweller on the Earth.

3 In the *Inhabitants* we are to consider two things: either the *Originall*, or the *Disposition*.

4 The *Originall* is the off-spring whence all *Inhabitants* tooke their beginning.

Concerning the originall of people of the Earth, we are to obserue two things; First, the *Distinction* of originall; Secondly, the *manner* of Inuention: For the first, we must note that all *Inhabitants* of the Earth, haue a *three-fold* originall or beginning. The *first* was from the first Creation, the *second* was immediatly after the generall deluge, wherein all the *seminary* of living creatures was preserved in the Arke: The *third*, is the first stocke or originall of each seuerall nation: For this last, it is a matter which we cannot here so well de-

fine,

fine, till we come to the particular description of each Religion, to which it properly belongs. It shall be enough in this generall part, to speake of the two first, as farre as approued *Historie* and *observation* shall direct vs: For the manner of finding out the originall of Nations, these rules are giuen vs by *Bodin* in his 9th chapter of the *methode of Historie*. The first is by the testimonie of approued *Authors*. The second is by the marks and footesteps of *Languages*. The third may be drawne from the *limits* and knowne bounds and situation of Countries. This knowledge of the *originall* of Nations, hath bin a matter of no small importance: For (as *Bodin* obserues) there is nothing which hath more exercis'd the wits of writers, or caused more ciuill discords and ruines of diuerse commonwealths, then the contention about the first originall of nations: which iarres and contentions (as I take it) spring from no other ground then the naturall pride in the minds of men, and the affection of *Nobility*: where by it often comes to passe, that such men as haue risen to greatnes, by their *Wealth*, *villanies*, or other such like meanes, haue afterwards, to continue and bolster vp their vsurped dignities, sought out new pedegrees and Ancesters, to set a glosse vpon their owne base beginnings; a humor in our daies more affected, then praise-worthy; not only of priuat perts, but of whole nations, which runne farre off to seek out their first originall, which with more ease and certainty, they might find nearer home. To let passe other examples we need goe no farther then the *French* and the *Britanes*, both which labour as much as may be, to deriue their first originall from the *Troians*. The first from the lineage of *Hector*, the other from *Antenor*; as if more glory were to be deriued from *Troian* fugitiues, then from the valiant nation of the ancient *Gauls* and *Germans*, from whom they might deriue a truer and a more certaine descent. The consideration of this antiquity of nations so farre forth as it concernes our *Geographicall* discourse, reseruing matters of more specialty to our *speciall* part, we will comprise in these Theoremes.

I *All Nations had their first originall from one stock, whence afterwards they became di-
vided.*

We must heere vnderstand (as we haue before noted) that all Nations haue a three fold originall, the first before the vniuersall deluge, the other soone after, the later long after. For the first, no doubt can be made by such as credit the truth of holy Scriptures, but it was from *Adam* the first father of mankind: For the last, it is doubtfull and various, and therefore cannot well be handled in generall, before we come to the description of particular countries; where we are determind to make a search as neere as can be in to their original: But that which we chiefly heere note is the *second* offspring of mankind soone after the flood: For certaine it is, that all mankind was confined to the familie of *Noah* in the *Arke*, so that their first originall must be drawne from the *Arke*, and that place where the *Arke* rested, presently vpon the falling of the waters: which we shall proue to be farre *Eastward*. Hence is the manifold arrogancy of many nations well discovered; for amongst the *ancients* some haue somuch affected the antiquity of their race, that forgetting their humane condition, they haue deriued their nobility from the Gods. Which humour hath not only invaded the minds & affections of foolish & ignorant men, but also of such as haue stood in great opinion and estimation of wisdom & vertue: In somuch as *Cesar* in a certaine oration to the people of *Rome*, was not ashamed to boast, that he was descended by his *Fathers* side from the Gods by his mother from *Kings*: As also *Aristotle* deriued his offspring from *Apollo* and *Esculapins*: which strang affection was little lesse in people of lower and baser condition, who either being vterly ignorant of their owne offspring, or at least dissembling it, for the hate they bore to strangers haue called themselves *Autochthons* which is as much to say, as a people bred of the same region, not fetching their descent from any other nation: In which sense *Aristides* in *Panathe-*

neis giues the greatest nobility to the *Athenians*; to wit, that being borne of the Earth the mother of the Gods, they deriued not their descent from any other forraigne countrie: and this error is obserued not only amongst the ancient, but also with the newer writers, to be so common, that *Polydore Virgil* otherwise a prudent writer, affirms the *Britaines* to be a people taking their originall from the *Inland* countries and not deriued farther. The like is written by *Athamerus* that the *German* nation being first bred in *Germany* owed their originall to no other; Which he labours to confirme out of *Tacitus*, *Sabellicus*, and *Sepontinus*. But (as *Bodin* speaks ingenuously) the ancient might well be excused in this error: But these men are subiect to great reprehension: 1. Because they being *Christians* seeme to reiect the authority of holy *Scriptures*, which testifie that all mankind was deriued frō the selfsame originall, being (as we haue said) all confined in the *Arke* of *Noah*. 2 Because by this meanes, giuing to nations no other originall; then from their owne countrie, they distract & divide each one from the mutuall loue and society of other Nations. For besides many other reasons which moued *Moses* to write of the *Genealogies* of people, this one seemes not the least, that men should vnderstand themselves to be all (as it were) kinne, and descended from the same originall; then which there is no greater meanes to conciliate and ioyne mens affections for mutuall amitie and conuersation. As it is reported of *Diomedes* & *Glaucus* and many others, who being armed to one anothers ruine and overthrow, haue bin drawne to breake off their hatred by the meere pretence and shew of consanguinitie. But these who so arrogantly boast themselves to be sonnes of the *Earth*, not beholding to any other country for their offspring, strue to breake in sunder the bonds of society betwixt nations, which *Gods word* and the Law of *Nations* binds vs to obserue. Hence grow those mortall hatreds and heart-burnings betwixt diuers countries, as of the *Egyptians* against the *Hebrewes*, of the *Greeks* against the *Latines*, wherein they persecuted one the other extremely. Hence came it to passe that *strangers* amongst the *Romanes*

were

were called enemies, as the name of *Welch-men* with the *German*s signifieth as much as a *forrainer*; wherein they seeme much to degenerate from the ancient hospitality of their Ancestors, for which they haue bin much praised. Finally from this one root spring those infamous libels cast out of one Nation against another, written by such *fire-brands* as delight in nothing more then dissention; but how much better were it to reconcile all people out of this assured ground of consanguinity, sith *Religion* perswades more to *charity* and agreement, then to *factions* and contentions. But this I leaue to the Diuine, whom it more properly concernes.

2 *The first inhabitants of the Earth were planted in Paradise, and thence translated to the places neare adioyning.*

For the confirmation of this point we need no farther proof then the authority of *God* himselſe, speaking in his word, whereon all truth is grounded; But of the place of *Paradise*, where we place the first habitation, sundry disputes haue bin amongst Diuines sufficiently examined, of late by a iudicious and worthy writer in his *History of the world*. Which tract being too tedious to insert, we will contract as farre as concernes our purpose. First therefore it would seeme meete that we examine their opinion, which hold this Historie of *Paradise* to be a meere *Allegory*: Of this opinion were *Origen*, *Philo* *Iudeus*, *Frav. Georgius* with many others: who by the soweriners of *Paradise* would haue to be understood the foure cardinall vertues: as by the *Tree of knowledge*, *sapience* or *wisdom*e: To which opinion also *St. Ambrose* seemes to adhere: who would haue that by *Paradise* should be meant the soule or mind, by *Adam* the understanding, by *Eue* the sense, by the serpent delectation, by the rest of the trees the vertues of the mind: Against the Fathers themselues I will not inueigh, sith some men suppose their conceits to be rather *allusions*, then *conclusions*. But against the opinion it selfe, many reasons may be drawne to proue there was a true locall *Paradise* Eastward: first out of the text it selfe, which saith; *For out of the*
ground

St. *Walter*
Raleigh.

ground made the Lord God to grow every tree pleasant to the sight, and good for meats: by the prooffe of which Story it seemes that God first created man out of the garden, as it were in the world at large, and then put him in this garden: the end whereof is exprest to dr^{esse} and manure it; *Paradise* being a garden filled with plants and trees, pleasant to behold, and good for meate: which proueth that *Paradise* was a terrestrial garden. Secondly, to expresse it more plainly, he averreth that it was watred with a river springing out of a Region called *Eden*, being a Country neare vnto *Canaan* in *Mesopotamia* as *Ezechiel* witnesseth. Thirdly *Epiphanius* and *S^t Hierome* vrge to this effect; if *Paradise* were such an *Allegory*, then were there no *Rivers*, no place out of which they sprung, no *Eue*, no *Adam*, and so the whole *History* should be turned into a meere fable, or poetickall fiction. Fourthly, it is proued by continuation of the same Story: 1 Because God gaue *Adam* free-will to eate of every tree of the garden (the foresaid tree excepted;) besides he left all the beaſts of the Earth to be named by him, which cannot be meant of imaginary trees and beaſts: for this were to make the whole Creation *enigmaticall*. 2 By This name is often vsed in holy Scriptures else-where, as in *Ezech.* 31. 9. *Genesis* 12. 19. which would not haue bin so, if the whole story had bin merely *Allegoricall*, and *Paradise* an *Utopia*; sith the Scriptures, specially the historicall part of them, are written in a plaine stile, fitting the capacity of vulgar auditors. Lastly of this *Paradise* planted in the East, we may find some footsteps in prophane Poets, as in *Homer*, *Orpheus*, *Linus*, *Pindarus*, *Hesiod*, who often speake of *Alcinous* garden, and the *Elisian* fields: all which deriued their first invention from this description of *Paradise*, recorded by *Moses* in Holy Scripture, whereof the *Heathen* themselues had some obscure traditions. The second opinion was, that *Paradise* was the whole Earth, and the Ocean the fountain of these foure rivers; which was defended heretofore by the *Manichees*, *Noviomagus*, *Vadianus*, and *Goropius Becanus*. The reasons which they alleage for their part to proue this assertion, were chiefly these: 1 Because those things which were in Scripture attri-

buted to *Paradise*, are generally ascribed to the whole world, as that place of *Genesis*; *Bring forth fruit and multiply, fill the earth, and subdue it, rule over every creature*. But this argument may easily be answered: for although the world in generall were created for man, and all men descended from the same originall, to wit, the loynes of *Adam*; yet this disproueth nothing the particular garden assigned to *Adam* to dresse, wherein he liued before his transgression: for if there had beene no other choyce, but that *Adam* had beene left to the *universall* (as they imagine,) why should *Moses* say, the garden was East from *Eden*: sith the world can not be East or West but in respect of particular places? Also why was the *Angel* set after *Adams* expulsion to barre his re-entrance, if it were not a particular place: for according to their opinion *Adam* should be driuen out of the whole World. Their second reason is, because it seemes impossible that *Nilus*, *Ganges*, and *Euphrates*, by so many portions of the world so farre distant, should issue out of the same fountaine. To this we answer, that by common *Interpreters* of Scripture, being ignorant of *Geographie*, *Pison* was falsely taken for *Ganges*, & *Gihon* for *Nilus*: Although it can no way be true that *Ganges* should be taken for a riuer by *Hauilah* in *India*, and *Nilus* should runne through *Ethiopia*, as we shall shew hereafter. The third opinion is, that *Paradise* is higher then the *Moone*, or higher at least then the Middle Region of the Aire: this opinion is cast vpon *Beda* and *Rabanus*; to which also *Rupertus* seemes to accord: who (as it seemes) borrowed their opinion from *Plato*, and he from *Socrates*. But these two (as it seemes) are misinterpreted, because by *Paradise* they meant Heauen it selfe as many imagine. But to confirme that this terrestriall *Paradise* is such a place, some men produce these Arguments. First that it is reported by *Solinus*, that there is a place exceeding delightful and healthsome on the top of Mount *Athos*, called *Acrothones*, which being seated about clouds, or raine, or such inconveniences, the people by reason of their long liues are called *Mauphsios*. Secondly they alleage for the hight of this *Paradise*, that *Enoch* was there preserved

from

from the violence of the flood, as *Isidore* and *Peter Lombard* maintain: But this opinion was of the Diuines condemned in the *Florentine* councell; and first where as they say, that such a pleasant place is in the top of the mountaine *Athos*; this neither proues that this is Paradise, neither is it so high as they would haue it: For euery high and pleasant place is not Paradise. Secondly, whereas they would haue *Enoch* and *Elias* preserved in the place, it is expressely against *Holy Scripture*, which affirms directly that the waters ouer-flowed all the mountaines, making no such distinction. Secondly, should we credite this, we might as well belieue that certain Giants saved themselves in that high place, as some haue believed. Besides the answer of their frivolous arguments, these reasons may be brought against their assertion: First, that such a place cannot be commodious to liue in: for being so neare the *moon*, it had also bin too neare the *sun*. Secondly, because in this sort it had bin too neare a neighbour to the Element of *fire*. Thirdly, because (as many hold) the *Aire* in that Region by the motion of the heauens is carried about so violently, as nothing there can well consist. Fourthly, because according to *Ptolemy*, the place between the *Earth* and the *Moone* is seuentene times the *Diameter* of the *Earth*, which make by a grosse account about 120000 miles. Hence it must needs follow that Paradise being lifted vp to this great hight, must haue the compasse of the whole *Earth* for a *basis* or foundation. But this cannot be imagined: first, because it would be subiect to the eyes and knowledge of men. Secondly, it would hide the light of the *Sunne* for the first part of the day being on the East side. Thirdly it would ouer-poize the *Earth*, and so make it to shrinke out of his place; one side being farre greater and heauier then the other. The fourth conceit is of *Tertullian*, *Bonaventure*, and *Durandus*, who would haue Paradise to be seated vnder the *Equatour*, because that contrary to the opinion of most of all the Ancients, they thought this place to be most pleasant and commodious for habitation. It is true that the places vnder the *Equinoctial* are not so burnt with the *Sunne*, as some thought: but, as we haue proued out

of later Navigatours, very pleasant and fruitfull for the most part: yet cannot this be the place of Paradise; forasmuch as the Riwers of Paradise mentioned in holy Scripture, are not found to meet there: which argument might also confute them which thought it was seated vnder the *North-pole*. The last opinion which I hold the truest, is of some later Writers, that Paradise was seated in a Region South-east from *Mesopotamia*, which is most amply and copiously proued by *S^r Walter Rawleigh*, to whom I referre my Reader: onely two reasons I will alleage. The first from the name of *Eden*, sith there is found an Iland of this name *North-west* from the place assigned, very fruitfull and pleasant in all commodities of the earth, and in later times knowne also by the name of *Eden*, which is likely to haue bin continued from the beginning. Secondly from the Riwers of Paradise, which cannot be imagined to meet in any part of the world: for *Tigris* and *Euphrates* it is certaine that they are found in this very Region: for the other Riuer *Gihon*, that it is falsely vnderstood of a Riuer running through *Ethiopia* is also most certaine; for such a Riuer could neuer meet with *Euphrates*, which is out of question one of the Riwers of Paradise: forasmuch as it is so far distant & diuided from it by the Mediterranean Sea: wherefore I am constrained rather to embrace their opinion which interpret *Chus* to be a part of *Arabia*, where *Chus* the father of *Noah* settled his first habitation; which for this cause he called after his own name: but afterward in proceſſe of time his posterity growing exceeding large and populous, they were enforced to passe ouer into *Africa*, and so settle themselves in *Ethiopia*, which place also they called after the same name: as we haue seene of later yeares the *Spaniards* at the first discovery of the *West Indies* called one place *Hispaniola*, and another *Hispania Nova* in remembrance of their former habitation. But howsoever it be, certain it is, that Paradise was seated in the East, from whence mankind had it's first off-spring And probable it is that *Adam* being excluded out of Paradise, was cast into some place neare adjoyning therevnto, which may also from our habitable place of the West, be accounted Eastward.

3 The first plantation of Inhabitants immediately after the Deluge begunne in the east.

As *Adam* the father of all Nations before the flood began his offspring in the *East*, neere *Paradise*, so the second father of Nations *Noah* in the *East* first beganne to repeople the world, after the deluge: Which besides the clearer testimony of holy Scripture, may sundry waies be demonstrated: First, because it is most certaine, that the Earth beganne first to be peopled, neere the place where the *Arke* rested, which is the mountaine *Ararat*: Whether this be a mountaine of *Armenia* as the cōmon Interpreters imagine; or the mountaine *Caucasus* betwixt *Scythia* & *India*, as some later Writers with greater probabilities haue guessed, hath suffred a great dispute; all agree in this that it was *Eastward*. I will not be here ouer curious, but refer it to our historicall part, where we shall particularly handle the memorable accidents, of particuler places: Enough it is to proue that the first plantatiō after the flood was *Eastward*: 2^{ly} no small probability is drawne from the civility, magnificence, and populousity of these *Easterne* nations before others: For it is certaine that many excellent *Arts* haue flourished amongst those *Easterne* people, before euer our *western* climat dreamed of such matters; Amongst many other matters, *Artillery* & *Printing* was in vse amongst the *Chinois* and *East Indies* of ancient time, long before this inuention was known to vs; as the *Portugalls* who haue trauided thither haue confirmed: To the vse of *gunnes* and ordinance; many suppose *Philostratus* to haue alluded, speaking in the life of *Apollonius Tyanus* lib: 2. cap: 14. Where he saith that the people dwelling betwixt *Hyphasis* and *Ganges* vse not to goe farre to warre, but drue away their enemies with thunder and lightning sent downe from *Iupiter*. By which meanes it is said that *Hercules* and *Bacchus* ioyning their forces were there defeated, and that *Hercules* there cast away his golden shield: For the other Inuention of letters how euer it were by the *Gracians* ascribed to *Cadmus*, as the first Inuentor, because he was the man that first discovered it to the *Gracians*; it is most

certaine that it was as ancient as *Seth*: And that *Printing* first came to vs, from this *Easterne* part, appeares by *John Guttemberg*, who brought it first out of the *Easterne* world: Which art *Conradus* being instructed in, brought the practise thereof to *Rome*, which afterward one *Gesnerus* a *French-man* much bettered and perfected: For howsoever amongst the *Europeans* this inuention seemed but newly borne, yet the *Chinois* had it before either the *Egyptians* or *Phanicians*: When the *Grecians* had neither knowledg nor ciuility: which is witnessed about a hundred yeares gone by the *Spaniards* and *Portugalls*. Farther for the magnificence of those nations, an argument may be drawne from the Historie of *Alexander* the great, who found more stately buildings and Cities in the litle kingdome of *Peru* which lay side by side against the *East Indies*, then in all his former trauailes: for in *Alexanders* time learning & ciuility were not spread so farre west as *Rome*: Neither did he esteeme of *Italy* any otherwise, then of a barbarous and uncivil place: which made him to turne his army rather against *Babilon* and the east, which seemed a farre worthier prize: Moreouer, *Paulus Venetus* shewes, that letters and discipline was first borrowed from the *easterne* people, without any returne of interest. A third reason may be from the extraordinarie strength of those *easterne* people in most ancient times. For it's reported by *Diodorus Siculus* out of *Clesias* that *Semiramis* the wife of *Ninus*, not many discentes from *Noah*, brought an army to invade *India*, of three millions, besides horses and waggoners: Neither had *Stanrobates* her aduersary smaller multitudes to encounter her: which extraordinary strength and multitude of men could not possibly issue out of any *Colony*, sent thither from the western parts: And therefore it must needs follow, that they had their first offspring and originall in those *easterne* parts neere *India*. Sundrie other reasons might bee alleaged, but these I suppose will suffice to fortifie this assertion. Then it is manifest that the first Plantation of nations begunne in the *easterne* parts of the Earth: But where we shall place and define this *Easterne* part, seemes a matter of greater difficulty then the o-

thers.

ther. *S^r Walter Rawleigh* out of the premised arguments would seeme to proue, that this first plantation was farre east as farre as *India*, neere which, he would haue the *Arke* to rest, to wit, on the mountaine *Caucasus* lying betwixt *India* & *Seythia*: Notwithstanding the authority of the learned Author, I find that the most ancient writers haue drawne the original of all nations soone after the flood, from the *Caldaans*, or at least amongst all, made them the first: For confirmation of which opinion, they vrge many strong arguments: In the first place, they vrge the testimonie of *Moses* in the 11 of *Genesis*, where speaking of the first assembly of people after the flood he relates, that they came from the *East* into the plains of *Shinaar*, in which place stood *Babilon* the chiefe seat of the *Caldaans*. To this they adde the testimonie of *Metasthenes*, *Herodotus*, *Ctesias*, & *Xenophon*: which haue afterwards bin seconded by *Diogenes Laertius*, *Philo*, *Porphyry* in a certaine epistle to *Boethus*, *Clemens Alexandrinus* in *Stromatis*: *Eusebius de Evangelica demonstratione*, *Theodoretus lib. 1. de Graciarum afflictionum curatione*, *Rabbi Moses Maymonis filius lib. 3. cap. 30 Perplexorum*: with almost all the Interpreters of the *Hebrewes*: All which with vniforme consent haue affirmed that *Civility*, *Arts* & *sciences*, deriued their first descent from the *Caldaans*. Hence they faigne that *Promethens* being a *Caldean*, for that he recalled men from a wilde life to a more ciuill conuersation, and taught the regular motion of the *stars* and *planets* before vnkowne, stole fire from *heauen*, and animated men formed out of clay, with a celestiaall soule. But aboue all which may be collected in this kind, no small argument may be drawne from the *markes* and *foote-steppes* of the *Hebrewe* and *Chaldy* tongues, which in no mixture of tongues, or proceffe of time could euer be abolished: For this being the first of all other languages, was preserved by *Abraham* and his posterity; And challengeth antiquity before euer the *Latin* or *Gracian* tongues had any memory: in so much as all the ancient nations of the world are found in most of their originall names of Gods, peoples, Princes, and places, to make vse of the *Hebrew* or *Chaldey* tongues, differing onely

Infracted, which without manifest wresting and absurdity, cannot well be deriued from other later languages. The first father of the people of *Europe* was *Iaphet* the sonne of *Noah*, according to the ioynt consent of Hebrewes, Græcians, and Latines: To which alludes the Poet, where he saies, *Andax Iapeti geniu*. This name רַבֶּת or *Iaphet* in Hebrew signifieth asmuch as Dilatation or enlargement: Whereas the Greeke Etymologists' ridiculously draw it from many other originalls: In the like sort *Tacitus* ignorant of the Hebrew, would haue the people of *Palestina* to be called *Iudei quasi Idæi* from the mountaane *Ida* in *Creete*, from which he dreames they were deriued; whereas the word in the Chaldy signifies, as much as Prayfers. In like manner *Ion* or (according to *Hammer*) *Iaon*, supposed the first Author of the *Iones*, would the Græcians deriue from a flower, whereas the word in Hebrew signifieth asmuch as a deceiver: Whence *Daniel* prophesied of *Alexander* the great, that the King of יָרָן that is *Iaon* or *Ianan* shou'd raigue in *Assyria*. Instances in this kind are infinite, as of *Danaus*, drawne from דָּן *Dan* which signifies a iudge, whence comes *Dardanus* which is the seat of Iudges: Of *Ianus* from יַיִן *Iayn* signifying wine, in which sense he is by *Halicarnissens* called *Oenotrius*: Of *Achæis* which signifies *Greece*, *Egypt* which is streight or narrow. *Nimrode* *Rebellious*. *Ninus* a sonne, *Ninine* the house of *Ninus*, *Solon quasi Solam* a peace maker. So *Cadmus* supposed to be the father of letters & learning, amongst the Græcians, signifies in the originall, so much as an Easterne man or an ancient man. Should we runne any further on this point, we should be thought to write a dictionary, for as much as all the ancient names amongst the Græcians spring from the same fountaine: Whence that *Egyptian* Priest had good reason to obiect to *Solon*: That the Græcians seemed children, because they had nothing ancient amongst them: But to better purpose a Christian obiected to the Græcians that *Moses* the Lawgiuer to the Christians was ancientser then all the Græcian Gods; Other reasons are taken from the Religion of the Hebrewes, out of which seeme to be deriued all the famous religions

religions of the Earth: For to let passe the Christian, Jewish, & Mahometan Religions at this day flourishing, all of them challenging great antiquity, and taking a great mixture from the truest and ancientest Hebrew discipline: It is manifest that in the Heathenish superstitions themselves, many footestepes have bin discovered: which will appeare by diuers Instances. These arguments I confesse seeme very strong, but yet not of sufficient strength to enforce credulity without other warrant: To say peremptorily with *Mr. Bodin*, that by the consent of ancient writers, the Caldeans are acknowledged the most ancient people, is more then I dare to venter: Neither is this opinion so strongly fortified with arguments, but Reason may steppe in to haue a doubtfull assault. Their first argument drawne from the testimony of holy Scriptures in the 11 of *Genesis*, seemes to stand on our side, altogether against them: For whereas it is said, that they came from the east into the plaine of *Shinaar*, it is manifest that the east was first peopled, or else how should this people come from the east into these plaines of *Shinaar*, to erect the tower of *Babel*? Secondly, whereas they vrge Arts, Civility, Magnificence of the *Caldeans*, we shall find it rather to agree to the people which dwell farther east, as is witnessed by the former instances. And if any object that at this day is found the contrary, for as much as we find the *Indian* to be a barbarous blind and ignorant Nation, in respect of the *Asiatickes* and *Europeans*, we answer two wayes: 1. First, that we find not by experience the *East-Indians* to be so altogether deuide of civility, but that we may obserue not only amongst them the footestepes, but also the practise of many ingenuous Arts, sage gouernment, policy, and magnificence, as amongst the *Chinis* & the large territory of the great *Mogull*. 2. It is not hard to imagine, that in so large a tract of time, the best seeded common wealthes should be brought to nought, arts, civility, magnificence, be forgotten, and the rarest inventions be cast into obliuion, especially by those two enemies of civility, warres & luxury: both which hauing the reignes in their own hands, are quickly able to abolish all wholesome discipline,

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both

both in Lawes and Religion. 3 Their Argument drawne from the footstepes of *Languages* in my shallow conceit, proues nothing els but that cinill Lawes, Arts, and Learning was deriued to the *Gracians* from the *Caldeans*, or the Nations neare adioyning, which formerly receiued it from them But how farre Learning might propagate it selfe the other way towards the East, is not a matter so cleare and out of question. The preservation of the Language (for ought I see) might grow from the continuance of the Religion, more firmly rooted, and for a long time continued in *Abraham's* posterity, whose abode was settled thereabouts, whereas the other farre divorced, aswell from their first spring, as the monumentall seales of their Religion, quickly turned Religion into Pagan Idolatry: Many reasons besides the disprouing of this former opinion may be alleaged to proue the *Easterne* part of the world to haue bin first peopled: amongst which I will only cull out this one, grounded on the text of holy *Scripture*. It is warranted out of the text: 1 That when the waters began to decrease vpon the face of the earth, and the *Arke* began to rest vpon the mountaine *Ararat*, *Noah* sent out a dove to make tryall, who returned with an oliue branch in her mouth. 2 That neare the place he issued out of the *Arke* with all his family, he planted a vineyard, and was drunke with the iuyce of the *Grape*, not knowing the strength thereof: out of which by all probable conjecture must needes be collected, that the Regions neare the place where the *Arke* first rested, by the benefit of Nature afforded both Vines and Oliues: for we cannot imagine the silly *Dove* at the time of the flood empty gorged to haue flowne very farre ouer the face of the waters to obtaine this Oliue branch, nor *Noah* after the flood to haue gone very farre to seeke out a convenient place for his Vineyard: whence it is most likely that the *Arke* rested in such a place, whose neare adjoining Regions are enriched with such commodities. But this cannot be verified of *Armenia*, wherein for ought my reading informes me, are found neither Vines, nor Oliues, whereas some places Eastward, whereon the *Arke* according to this other opinion was supposed to rest.

rest, afford both in great plenty. To vmpste betwixt these two opinions, I leaue to my friendly Readers; because it is not in our power to command, but obey Reason.

C H A P. XIII.

OF the *originall* of Inhabitants of the Earth we haue spoken: It remains wee now treat of their naturall Disposition.

There is nothing more subiect to admiration, then the diversity of naturall Dispositions in Nations; a matter evident to the eye of obseruation, and needing no prooffe or demonstration: for who obserues not in all Nations certaine naturall or nationall vertues or vices, which neither time nor Lawes could euer change or correct. For not to roue fart her off then our neighbouring Nations Confines; what Writer in this kind almost, were he not very partiall, hath not taxed pride and ambition in the *Spaniard*; leuity, or rather (as *Bodin* would haue it) temerity in the *French*; dangerous dissimulation in the *Italian*; Drunkenness in the *Dutch*; Falshood in the *Irish*; and gluttony in the *Englisch*? And howsoever many means haue bin put in practise, either by the seuerity of lawes to curb such enormities, or the subtilty of discourse to shroud these vices vnder the name of vertues: yet these markes are found to stick as close as the spots vnto the Leopard, as neither altering their pristine hue, or yeelding to time or statutes: And if it happened at any time that by extraordinary violence some litle alteration were wrought, yet some few yeares would find it returne againe vnto his own nature and disposition. This variety of dispositions being very many, and depending on sundry causes, to helpe memory, we will reduce into certaine heads, out of which in the generall we may giue

a iudgment, leaving the rest to our speciall Tract. The name of naturall disposition in this place we take in the largest sense; so farre forth as it comprehends vnder it the Complexion, Manners, Actions, Languages, Lawes, Religion, and Government. All which so farre forth as they depend from the places we will shew. Neither intend we to handle nicely all these specialties, forasmuch as the Manners, Customes, Lawes, (and for a great part) the externall rites of Religion depend on the naturall constitution of the Inhabitants: so that little can be spoken of the naturall constitution, but of such actions, effects and markes as shew themselves in their ordinary customes & manners. Wherefore we shall be constrained to treat of them together, the one being a great furtherance to the explanation of the other.

2 The natural disposition of the Inhabitants of the Earth may suffer change and diuersity, either in respect of the site, or in respect of the quality of the soile, or in regard of the Inhabitants themselves.

3 The site is the respect which one place in position beareth to another: Here a Nation is divided into, 1 The *Northerne* or *Southerne*, 2 The *Easterne* or *Westerne*.

4 The *Northerne* is placed in the North Hemisphere, betwixt the *Equatour* and the *Artick Pole*. The *Southerne* on the opposite side betwixt the *Equatour* and the *Antarticke Pole*.

Of the *Northerne* and *Southerne* inhabitants we speake not here respectiue, as in regard of the same Hemisphere, but absolutely in regard of the two Hemispheres and their

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Inhabitants: Now these 2 Hemispheres of North and South are varied in respect of the quantity and disposition of the soile deciphered before. What diversity shall be found in the people or inhabitants shall be shewed in this Theoreme.

I The people of the Northern Hemisphere as well in riches and magnificence, as valour, science, and civill government farre surpass the people of the South Hemisphere.

The people of the Northern Hemisphere we understand to be the *Europeans*, the *Africans*, the *Indians*, the *Asians*, being the greater part the Inhabitants of *America Mexicana*, with the highermost part of *America Peruana* together with the people inhabiting the unknowne land, lying under the Arctick pole, with all the Islands belonging to each of these. The people of the Southern Hemisphere contained mostly Southward of the *Africans*, the inhabitants of *America Peruana* for the most part, the people of the *Terra Australis incognita* or the South Indies, with some Islands belonging thereto. Between these two partitions, if we make a comparison, we shall find a greater disparity then any human invention could any waies reduce to any shadow of Equality, or any Travellers observation could ever seepe into diminish. To begin with the riches: It is certain, that the increase of it in any nation proceeds, either from the benefit of the soile or from the skill and diligence of the inhabitants. The benefit of the soile either in respect of the quantity of the ground, or of the quality of the soile in this southerne part, we have at large proved to be farre inferior to that of the Northern hemisphere. The diligence of the people we can measure no otherwise then by their Traffick with forraigne nations, or their good husbandrie of their owne commodities. Their traffick with forraigne nations, is suspected to be little or nothing at all, in respect of the northerne Inhabitants having small commerce or knowledge of forreigne nations, and that rather enforced by violence and conquests, then any way desired of

them: Whereas scarce can be found any nation of the Earth; which cannot by commerce or traffick with forraigne Countries, at leest neighbouring confines both strengthen theselues, & draw riches from other nations: Lesse can be hoped from their homebred industrie, which is content with sufficiency, neuer aiming at farther riches then naturall necessity seemes to exact, as may appeare by all records and Histories almost which haue treated of this matter. If we consider the *state* & magnificence of either, we shall acknowledge a great difference, as disdaining all comparison. The first offspring of all nations owes it selfe (as we haue proued) to our Northerne-hemisphere, which that Almighty Creatour of all things blessed with knowledge and ciuill gouernment, before euer this Southerne coast was knowne or mentioned. All the acts of the *old* and *new* Testament performed on this side of the *E-*quator, can speake the *state* and magnificence of these nations, leauing the other as yet neglected without memorie or Historie. Neither hath the Christian religion, the true ground of all settled gouernment euer bin so propitious, as to smile on these miserable Nations, as yet groaning vnder the seruite bonds of grosse Ignorance and Pagan superstition. Where shall we find in any records or antiquities, any state amongst them to parellell the foure greater Monarchies of the *Assyrians*, *Medes*, and *Persians*, *Gracians*, and *Romans*, or the later risen vp out of their ashes, whereof this one age can produce no few examples? What place is extant at this day in *Europe*, *Asia*, the Northerne tract of *Africk* or *America* (some few Deserts onely excepted) which haue not bin either by knowledge receiued from forraigne Nations, or some other meanes in some sort reduced to civility? At least to haue embraced some settled forme of gouernment: Whereas the Regions daily discovered in the Southerne moiety are found most barbarous, without lawes, sciences, or civility. Or if any such perfection shew it selfe amongst them, it is manifest that it is owed altogether, to the industrie of the Europeans, who with great cost and trauaile, haue brought them such riches whereof the poore wretches neuer knew the want. Instead of

so many Colonies sent out of Europe & Asia into these Southerne Regions, no record I suppose can mention one euer sent from them vnto vs. Which is an argument of their ignorance and want of traffick. What shall I speake of the valour and prowesse of the Northerne inhabitants, hauing by the sword erected so many kingdomes, and (as it were) without resistance brought into captiuitie those Nations of the South? of Arts and Sciences what can be said, but that the Northerne Inhabitant hath all, and the other in a manner none: For liberrall and ingenious sciences our Schooles and Vniuersities dispersed in most parts of *Europe* and else-where can speake our glorie: Which for ought I could euer learne the Southerne Continent, neuer saw; and admit they know some thing in some Mechanicall arts, it is no more then necessity requires. Neither in the number and extent of Inuention, or curiosities of workmanship answerable to that we find at home. The artes of Printing & Artillery were I suppose neuer of their acquaintance, except perhaps the later, which I dare sweare hath had better acquaintance then welcome; as that which neuer shewed it selfe but to their ruine: No obiection can heere take place in this comparison, except some man suppose the monuments and Trophies of these nations, either being very ancient haue miscarried by time, or else being of a newer birth are hid, wanting the light of discouerie: But this is a mere conjecture wanting ground: For what Antiquity or record could euer shew so much, as the footesteps or marches of any such monuments? as for the countries as yet vndiscovered, no better conjecturall iudgement can be giuen, then by that which is already found: For where all other reason and obseruation is silent, I alwaies hold equality the best measure: Another argument not inferiour to the rest, is the antiquity of the Northerne nations, which without all question is farre greater then that of the Southerne: Because we cannot imagine any man so adventurous to passe into these remote quarters, till such times as the places neerer adioyning, growing too populous, constrained them to seeke out a new habitation: which no man could conceiue to be but in many yeares

after

after the vniuersall Deluge.

- 5 Each Hemisphære with the inhabitants therein contained, may againe be diuided according to the *Longitude* or *Latitude*: according to the *Latitude*, inhabitants may be called either the Extreame or Middle.
- 6 The Extreame inhabitants are either the *Northerne* or *Southerne*. The former in the hither Hemisphære. The other are the inhabitants thereunto opposite in the other Hemisphære.
- 7 The middle Inhabitants are such as are situate in the middle betwixt the Equatour and the Pole in either Hemisphære.

The mistaking of the true limits of North and South in this our Northerne Hemisphære, hath caused great error amongst the Ancients: Inasmuch as *Hippocrates* pronounced the people of the North to be of a leane & dry disposition, of a small and dwarfish stature; whereas other Writers out of a good obseruation haue found them to be of a tall stature, big-boned, & of a more able constitution in respect of those of the South. To compose which difference we must haue recourse to that sub-*partition* of the Hemisphære before mentioned, wherein we allotted of the 50 degrees accompted from the Equatour to the Pole, 20 for heat, 30 for cold, & 30 for temperment; Whereof the former lyeth Southward to the Equatour; The second is accompted from the Pole; the other is conceived to lye betwixt both. But because we find this Mathematicall diuision to be too precis, to answer the obseruation of Writers in this kinde, we must a little alter these bounds, that these rules may rather stoop to *Nature* and obseruation, then

then *Nature* be squared to our owne conceits; yet shall wee shew in a generality, and for the most part, that the naturall disposition of the Inhabitants, ought to be iudged and measured according to these limits: though not exactly answering in precise degrees. Wherefore towards the North we limit these (with *Bodin* and other good Writers) which ly from the 50th degree Northward to the 70th; in which Tract we shall find our *Brittaines*, *Ireland*, *Denmarke*, *Gotland*, the lower *Germany* from *Moenus* & *Hipanus* to *Scythia* & *Tartary*, which take vp a great part of *Europe* & *Asia*: on the South we place the most Southerly *Spaniards*, the *Sicilians*, *Peloponnesians*, *Cretians*, *Syrians*, *Arabians*, *Persians*, *Susians*, *Gedrosians*, *Indians*, *Egyptians*, *Cyrenians*, *Carthaginians*, *Numidians*, *Lybi-ans*, *Moores*, and the Inhabitants of *Florida* in *America*. The middle Region is meant that which lyes iust in the middle place betwixt the Tropick and the Pole; not that which lyes betwixt the Pole and the Line: the reason whereof we haue shewed before; because the places vnder the Tropicks are found to be hottest, but vnder the Line more temperate; so that our temperate Clime here we place that which beginnes at the 40, and endeth at the 50 degree of latitude: In which Climat by the Northernmost *Spain*, *France*, *Italy*, the higher *Germany* (as farre as the *Mase*) both *Hungaries*, *Illyria*, both *Myssia*, *Dacia*, *Moldavia*, *Macedon*, *Thrace*, and the better part of *Asia* the lesser, *Armenia*, *Parthia*, *Sogdiana*, and a great part of the greater *Asia*: so that all the Nations as yet mentioned in histories, and perfectly discovered in our Northern Hemisphere are contained betwixt the 30 degrees of latitude and the 60. What to thinke of the Nations dwelling betwixt the two Tropicks, and those which are 60 degrees to the Pole, for want of accurate obseruation and History we can set downe no certainty: yet so farre as men may iudge by conjecture, we may accompt in the Region betwixt the Tropicks, the 15 degrees from the Tropicke towards the Line, to be of like quality with the 15 degrees without the Tropicke. The Tract in the middle vnder the Equiour, being more temperate, then that of the Tropicks, may be iudged to come neare

the temper of the middle Region betwixt the Tropick and the Line, though perhaps somewhat hotter. For the Regions very neare the Poles, lesse certainty can be collected: yet that little which we find concerning the nature of these Inhabitants we will not omit. According to this partition of our Northern Hemisphere, we may make judgment of the other; because where no other cause shewes it self, we may well guesse these places which are of equall site to be of a quall disposition, so farre forth as they respect the heauenly operation. All which concerne the naturall disposition of the Inhabitants, we will reduce to these three heads; to wit either 1 the bodily qualities; 2 the mentall Affections, 3 the outward Actions.

1 *The Extreame Inhabitants toward either Pole, are in complexion Hot and Moist: Those toward the Æquatour Cold and Dry: those of the middle indifferent as partaking of both.*

The confirmation of this proposition depends on 2 points: the first is the Declaration of the Cause of this Diuersity: the second is the effects and diuerse tokens which this variety of temper produces, as well in the Accidents of the *Body*, as the *Mind*. The cause we haue partly before opened, which is the Heat of the *Sunne* in Climates nearer the *Æquatour*, and the Cold in places farther remote, and situate nearer the *Pole*: whereof the former, working on the *Internall heat* and moisture of men and all other liuing creatures liuing in those hot Climates, drawes it out, and consumes it in such sort, that little remaines but cold and dry melancholy, as the Seas in the bottom, the other parts being (as it were) evaporated: For by how much more heat any man receiues outwardly from the heat of the *Sunne*, so much more wants he the same inwardly; which euery man may see confirmed out of ordinary experience; since that our naturall heat is far more vigorous in winter then in summer, and that our joints are more operative in frosty weather, and then when the Northwinde is stirring. On the

the other side in the *Summer* we commonly obserue the contrary: we find our joints lazy and heavy, our *Appetites* dull, as may also be perceiued in the *English*, *Germans*, and *French*, trauiailing from the *North* Southerly into *Italy* and *Spaine*, who if they confine not their diet to a sparing rate, they commonly are surprized by surfets: an example we haue of *Philip* Duke of *Austria*, liuing in *Spaine* after his *German* fashion. But on the contrary if a *Spaniard*, who in his own Country is inured to great Niggardlineffe, arriue in our *Northerne* Countrey, he commonly proues a better trencher-man then our native Inhabitants. And this *Bodin* obserues to fall out true, not only in men, but also in *beasts*, which driuen towards the *North* waxe fat, and proue well; but towards the *South* they pine away and waxe leane: which may well be confirmed out of *Leo Afer*, who auerres, that almost throughout all *Africa* you shall find few or no herds of cattle or horses; few sheepe, and scarce any milke: whereas each mans Table almost in *Germany* and *Britanny* can giue a plaine demonstration of our Countreyes store in this kind. Hence may appeare that as the heat of the Sun towards the *Aequatour*, by drawing out the internall heat and moisture causeth men inwardly to be left cold and dry; so towards the *Pole* the internall moisture being preserved from the Excesse of Externall heate, and the internall heat being strengthened and thickned by externall cold, haue left vnto them a complexion of heat and moisture. The middle Region betwixt both extreames being compounded of both, must needs by mixture and participation enioy a middle quality. Besides this exposition of the causes of this temper we shall obserue many speciall markes and Instances which will discouer this variety of disposition. First, it is plain that heat and moisture are the two qualities of fecundity. Whence it must consequently follow, those Regions which are most populous to be chiefly endowed with this quality and disposition. Now where shall we of this Hemisphere find any Country to whom Nature owes a greater increase of mankind, but in the *North* amongst the *Gathes*, the *Scythians*, the *Scandians*, and *Germans*, by whose abun-

dant fertility, vast desarts haue bin cultured and inhabited; stately Cities haue bin founded, Colonies haue bin transported and deriued almost into all *Europe*? Hence haue *Aethiopi*, and *P. Diaconus* compared the armies of the North to swarmes of Bees; and the North is termed by *Olaus Magnus*, the store-house of mankind: to wit, from which so many strong Nations, as the *Goths*, the *Gepids*, the *Hunnes*, the *Cymbrians*, the *Lumbards*, the *Alani*, the *Burgundians*, the *Normans*, the *Picts*, the *Heruli*, the *Sueuians*, the *Slavi*, the *Switzers* and the *Russians* are not ashamed to deriue their Ancestry. But here may be objected that the *Southerne* people are much more addicted to *Venerie* then the *Northerne*, which seemes an argument of greater Heat: But to this I answer, that this insatiate appetite of *Venerie* in the *Southerne* people, proceeds not frō heat, but frō *Choler Adust*, & *Melancholy*: which humours carry in them a salt & sharpe quality (according to Physicians) which stirres vp their appetite to *Venerie*: which we may plainly obserue by experience: for no men are more moued by this itching appetite of carnall Copulation, then *Melancholy* men. But howsoeuer this affection is most predominant in such men, yet it is hardly seconded by performance; which makes Geographers to ascribe more propnes of generation to the *Northerne* men, although sensuall concupiscence raigne more in the *Southerne* men; which indifferent proportion was without doubt granted to either, by the prouidence of *Almighty God*, that they who were endowed with a greater sufficiency, should lesse affect sensuall delights then the rest, which want that proportion of *heate* and *moisture*. And those of the other sort should haue their Appetites more raised vp to wantonnesse, without the which their off-spring would soone faile. A second argument to proue our assertion is the *Tall* and large *stature* of the *Northerne* man, which argues both heat and moisture; where as the *Southerne* man is small and dwarfish in stature, composed of weake and feeble Nerves. That the people situate towards the Pole in a moderate distance, surpasse in *greatnesse*, can be showne not only in this our *Hemisphere* in the *German*, *Scythians*, *Belgians*, and

and others; But also in the other by the *Pantagones*, whose situation Southward answeres somewhat neerely to the height of *Germany*. That moisture is a great cause of growth, appeares as well by Trees and other vegetalls, which growing in low and marish grounds increase to a most incredible greatness; as of those fore-mentioned on the side of *Rio Negro* in *Peru*, and neere the Lake *Hiarota* in *India* as by Beasts. For first we finde the moisteest to be of greatest stature, which is the reason why the great Whales and fishes in the sea grow to such a vast quantity. Secondly such Beasts as haue hot & moist bodies cannot so well prosper and liue in those Southerne countries; as the horse which by nature being hot and moist, liueth but faintly in *Ethiopia*, yet is of good strength in *Scythia*; Whereas the Ass being by nature hot and dry is of great accompt and seruice in *Africk*, in *Europe* little respected; in *Scythia* cannot liue. Neither is moisture sufficient for the growth except it be stirred vp by heat: wherefore we may conclude hence that the Northerne man hath both. Out of the contrary effects, we may likewise collect, that the Southerne man wants this quality. These reasons indifferently proue the equalities to wit, of heat and moisture, to be in the Northerne man, and the contrary in the Southerne. Diuerse other arguments are vied, some to proue the one quality, some the other apart. A great argument of heat in the Northerne man may be his extraordinary drinking. A vice which could neuer be reformed or corrected by times or places. This drowth of theirs stirring vp this desire of drinking, can proceed from no other cause then their heat. Whereas the Southerne man is seldome taxed of this vice: not because he is more religiously temperat then the Northerne; but rather for the naturall temper of his body, which can neither require, or beare so much as the Northerne. In so much as *Bodm* seems to make a doubt, whether the immoderate drinking of the *Germans* is to be esteemed a greater fault, then the niggardly sparing humour of the *Italians*: such both arise rather out of nature then education. Another argument of heat in the Northerne man, is the extraordinary strength

in respect of the Southerne man, which is an apparant demonstration of heat. We find that the blood of the *Scythians* is full of small strings such as are in the gore of Bulls and Bores, and betokeneth strength: Whereas the blood of the *African* is thinne, such as is in a Hart or Hare. No lesse are those reasons which especially proue the Northerne man to be endowed with much moisture. Thirdly we may much better argue from the Physiognomicall accidents of the body: we shall find the inhabitants vnder the *Tropickes* to be exceeding black: vnder the *Pole* it selfe beyond 60 degrees somewhat browne, but from thence about 60 their colour is reddish: from thence to 45 degrees whitish: about the 20 they begin to wax yellow; and then somewhat enclining to greener: all which proceeds out of the variety of heat and cold. For the Blacknesse of the *Africans* about the *Tropickes*, we can ascribe to no other certaine cause, then externall heat, and internall cold his necessary concomitant: neere to which approcheth the yellow and greene colour of the people not farre off. Whereof the former discouers *Choller* and *Adustion*: the other *melancholy*. And how soeuer the brownnesse of the people dwelling very neere the *Pole* may come by reason of externall cold, which by excessse rather dries vp their moisture, then strengthens the internall heat: Yet the Red colour of the *Inhabitants* about 60 degrees is a firme argument of heat: and the white hue of the middle people, an apparant marke of a middle temper. No lesse may be collected from the eyes and haire of these three Nations. The eyes of the *Scythians* are generally tending to a gray colour: The remote haue them of a *blew-whitish shining* colour: as the *Cymbrians* and *Danes* according to *Plutarch*. The *Britannes*, *Germans*, and *Normans* come neere vnto this colour, but haue them not altogether so gray and shining but more obscure. But the Southerne man hath the colour of his eyes much enclining to black. Now if we will beleaue *Aristotle* in his *Problemes*, the gray colour of the eyes is a very great argument of heat: But the blackish colour argues the want of heat: Those which dwell in the middle Regions, haue for the most part their eyes of a *darke-blew* which colour

colour is apparant in the eyes of *Gouttes*, which as *Pliny* writes are neuer purblind or dim of sight. Many special arguments besides those before mentioned, are produced to shew the *Northerne* man to surpasse in moisture as the other in drouth: The first may be taken frō their voice, which in the *Scythian*, or *Northerne* man is tending to hoarsenes; but in the *Africans* very sharp & shrill, the *Ethiopians*, & *Carthaginians*, and the most southerly as in *Spaniards*. That this difference doth arise frō the moisture of the one, & the want of it in the other may as easily be perswaded; because we obserue *women* which are moister then men, to haue sharp & shriller voices: Also that too much moisture in wood or mettall makes the sound of it very hoarse and harsh; as we see in lead, whereas other mettalls giue a shriller sound: Another reason is drawne from their extraordinary sweating; for it is obserued, that *Northerne* men tra- uayling towards the *South*, or warring in hotter Countreies, are like to faint and perish through extraordinary sweating, as *Plutarch* in the life of *Marinus*, records of the moist bodies of the *Cimbrians*. Thirdly it might seeme wonderfull which *Tacitus* relates of the *German* nation, that they loue *sloth* and yet hate *rest*; because (as in Children) the naturall heat pro- uokes them to *Action*, but the moisture procures *Softnesse*: whence they must either fight or sleepe. Hence the *Italians* & *Spaniards* make accompt, if they can suffer or withstand the first or second assault of the *French* or *Germans*, easily to van- quish them; because as *Marinus* and *Cesar* obserued of the *French*, that in the first assault they shewed themselves more then men, in the second lesse then *women*. A fourth reason not inferiour to the rest may be drawne from the *soft bodies*, of the *Germans* and *Scythians*, not any way patient of *tal air*, *hun- ger*, and *thirst*, although very strong and able to giue a sud- daine encounter or venter on a warlike exploit: The contrary in all shall we find in the *Southerne* man; out of which we may well collect, that he enioyes a contrary temper: Besides all which we haue said concerning this assertion more shall ap- peare hereafter by these subsequent Theoremes.

2. The extreame Inhabitants towards the Poles are more naturally inclined to Mechanicall workes and Martiall endeauours: the Extreame towards the Equatour to workes of Religion and Contemplation: the middle to lawes and civility.

There are found 3 kinds of discipline, which vsually invade and occupy the mind and faculties of man: The first are *mechanicall* and externall operations, the which are prosecuted in the *Intellectuall* part, yet receiue their perfection from the *hands* and externall organs; Such as are *Artillery*, making of *ordnance*; casting of *mettalls*, and *chymicall* inuentions, *Printing* and the like arts. The second is *Contemplation*, separate & removed from externall operation. The third as the meane betwixt both, is *civill* and morall discipline, whose act and perfection consists, in the making of *Lawes*, establishing and governing of *States*, prescribing and maintaining of *diuine worship*, with other matters of the like nature. These gifts it pleased God so to distribute to mankind, that the former should be most appropriate to the *Northerne* man; the second to the *Southerne*, the third to the inhabitants of the *middle* region; in such wise as the one should need and not enuy the others perfection. All which we shall demonstrate first out of the *causes* and ground; Secondly, out of the *effects*. The causes we haue shewed in the former Theoreme, wherein we haue ascribed to the *Northerne* man abundance of *heat* and *moisture* in respect of the other; which are the cheifst aides of the *imagination*, on which mechanicall faculties depend; also their plenty of bloud and humours distempering their minds: they are, by this meanes lesse giuen to contemplation. The *Southerne* men hauing *cold* and *dry* braines are of greatest vnderstanding in *Contemplative* matters, being (as it were) by reason of *melancholy* abstract from externall operation. The *middle* temper of the braine and humours must needs

be the mother of a *middle* discipline, which is found to be that which concernes *manners, lawes, and religion*. Heere somehaue gone about to *reduce* these three kinds of people to three planets answerable to these 3 dispositions. Over the Southerne people they set *Saturne*: the Northerne they commit to the government of *Mars*, the middle inhabitants to *Iupiter*. The power of *Saturne* according to the *Chaldeans* consists in *Contemplation*: of *Iupiter* in *practicall* action, of *Mars* in *Artifici- all* operation. Which 3 properties may be well gathered out of the *Hebrew* tongue, natures best interpreter; for *Saturne* they call שבתאי which is as much to say as quiet; because nothing better befits the nature of contemplation then retired quietnesse: *Iupiter* they call יושף which is as much to say as *Iust*: Which the *Gracians* hauing receiued from these *He- bremes*, they fained *Iupiter* to be the God of Iustice. *Mars* they called מאדים which signifieth strong or puissant, for which cause the *Chaldeans* and the *Gracians* would haue *Mars* the God of warre. To *Saturne* they ascribe cold, to *Mars* heat, to *Iupiter* a temperature betwixt both. To the first, they impute the inuention of *sciences* and such as concerne *contemplation*; To the second *practicall* prudence; To the third *Arts* and *workmanship*. Whereof the first depends from the *understanding*, the second from *practicall* discourse, the last from the operation of the *phantasie*. But to come neerer the matter and descend to particulars: we will first beginne with the *Northerne* man whom we shall find to be the father of most *mechanicall* Inuentions as of *Gunnes, Printing*, the art of *liquefaction*, *Chimistrie* with infinite other excellent *Arts*. Hence it comes to passe that the *Italians* and *Spaniards*, are vsed to send ouer for *Britaines* and *Germans*, as for those which are endowed with a heauenly gift in the Inuention of *veines of metalls* vnder the Earth, as also for the opening and well ordering of such *Mines*: Let any man cast his eyes on *England*, the *Neither-lands*, *Germany*, he shall find the *Inha- bitants* generally, either as the Scho lers and darlings of *Mars* weilding their *swords*, or as *Pioners* leuelling of mountaines, or as *Ingmers* contriving the course of waters, or hunting in

the woods, or *plowing* in the field, or looking to their *stockes* on the mountaines, or *working* in their shops, or at least let vpon some externall worke or other; that their wits (as *Bodin* merily speakes) might seeme to be in their handes. From whence come for the most part our feuerall sortes of *stiffes*, our choïce workes in *wood*, *mettall*, *Ivory*, our variety of instruments, from the *Italian* or *Spaniard*? No truly: they can rather admire then imitate; and better let vs the materials then inuent the workmanship, like those distressed *Israelites* which were enforced to runne vnto the *Philistines* to haue their swords sharpened. As we ascribe to those nations of the North this perfection in operative and externall faculties; So cannot we deny the Southerne man his due prorogatiue, which is *Religion* and *contemplation*. For these nations being aboute all other affected with *m^elancholy*, willingly withdraw themselves from common society into *Desarts*, and remote réceptacles, more accommodated to abstracted meditation: For contemplation (being of the *Hebrewes* tearmed a *precious death*) hath a speciall force to sharpen the wits of men, and by separation (as it were) from the dregges of the vulgar, not onely opens vnto him the secrets of nature, but giues him wings to flie vpto heauen in sacred meditation. Whence it cannot seeme strange that from these parts at first proceeded the *Prophets*, *Philosophers*, *Mathematicians* of great estimation. Also that almost all *Religions* of any great moment, owe their first originall to those parts: we need roue no further then the *H^ebrewes*, *Chaldeans*, *Egyptians*, *Gracians*, whome we shall find the first founders of *diuine* and *humane* sciences. Which historicall obseruation dissents not any whit from the iudgement of the *Naturalists*: Because (as *Huartus* obserues) the true foment of the best vnderstanding, consists in the cold and *dry brain* incident to melancholy. And *Aristotle* obserues, that *beasts* themselves are so much the more adiudged to approach the prudence of man, by how much they partake the quality of cold. An instance of which may be giuen in the *Elephant*, whose bloud (according to *Pliny's* Testimony) is coldest of all other Creatures. To this I might adde for an argument.

gument of the religious disposition of the *Southerne* man, what *Leo Afer* writes concerning the vast number of Temples in some places of *Africke*, as about *Fesse & Morocco*, their strict observation of holy rites, their rigide *Ecclesiasticall* censure, with such like. What is spoken by *Aluares* of the tall *Amara* in the midst of *Africke*, of their strange *Library, Churches, Pallaces*, with other matters of this purpose, would serue well to my purpose, had I the ingenuity to beleeue the Iesuite. But against this may be objected perchance that the *Christian* religion which is the truest and onely religion hath no great footing as yet amongst those *Southerne* nations. Secondly that their Churches haue no perfect platforme of *Ecclesiasticall* gouernment, as we find in other Churches towards the *Northerne* tract. To the first I answere; that we heere speake of the *Inclination* of men to religious exercises, so farre forth as it depends on their naturall disposition, not respecting this or that religion; for to be informed in the true religion and reject all other, depends not any way on the naturall *Inclination* of men, but on the immediate giuft of the Almighty God, which is pleased oftentimes to make election of one nation before the other, to make the one (according to the *Apostle*) a vessell of honour, the other of dishonour. To the second I likewise answere, that in *Religion* 2 things are to be considered: First the *Religious* and deuoute *Inclination* of man to embrace diuine contemplation: Secondly the well ordering and gouerning of religious actions, according to *Lawes* and *statutes* pertaining to the externall regiment of the Church. The former only being granted to the *Southerne* man, we may ascribe the perfection of the other to the people of the middle region, whom we haue pronounced to be most happy in the managing of *civill* affaires and *politicke* gouernment. Now to proue this people to be best endowed with this facultie, many reasons may be alleaged; because according to the testimonie of most approued writers, we haue found *lawes, manners, statutes*, and the best manner of gouerning common-wealths to haue proceeded from these nations. For *Histories* will shew vs, that the greatest and best empires

of the world haue flourished in *Asia*, *Greece*, *Asyria*, *Italy*, *France*, *Germany*, which lie betwixt the *Æquatour* and the *Pole*, from the 40 to the 50 degrees: And that out of these haue alway proceeded the best commanders, the most prudent *states-men* and *Law-giuers*, the wisest *Lawiers*, the most eloquent *Oratours*, the *warriest* marchants. Whereas neither *Africa* in the *South* nor *Scythia* in the *North*, could euer boast of many *Law-giuers* or *states men* worthy note; whence *Galen* complaines that *Scythia* neuer brought forth any *Philosopher* besides *Anacharsis* of any great credit.

3 The People of the Extreame Region towards the Poles in martiall promesse haue commonly proued stronger then those neare the *Æquatour*: but the middle people more prouident then either in the establishment and preservation of Common-wealths.

The grounds of this Proposition we haue laid before: for the former clause, that the people of the North should proue more puissant then these of the South, may well be concluded out of their naturall strength of body, and their courage of the minde: whereof the latter makes them ready to attempt, the other to execute most chivalrous designs. Neither want there most true and pregnant examples in history to second this principle: for euery man that is indifferently scene in history may obserue with wonder how the strong Nations of the *Scythians* haue invaded the *South*, winning from them many *Trophies* and victories: whereas we seldome find any expedition set on from the South to the North (except to the losse or ruine of the South) worth any memorable relation. To this many would haue these threatning prophecies of *Ier. Ezech. & Esay* to allude, which foretold, that from the North should issue warres, troopes of horsemen, & the Ruines of Kingdomes: This we shall obserue to be true not only in the generall, but al-

most in all particular States, which we shall find propagated from the North to the South. The *Assyrians* at first overcame the *Chaldeans*; the *Medes* the *Assyrians*; the *Persians* the *Medes*, the *Greekes* the *Persians*, the *Parthians* the *Greekes*, the *Romans* the *Carthaginians*, the *Goths* the *Romans*, the *Turkes* the *Arabians*, the *Tartars* the *Turkes*: and howsoever the *Romans* by their prowess wanne somewhat towards the North, yet found they by experience that beyond *Danubius* no great matter was to be expected; forasmuch as these Nations could not be easily vanquished, and being overcome would not away with subjection: which (as some say) was the cause that *Traian* having built a great Bridge of stone over the *Danow*, was perswaded to breake it downe. *Tacitus* expressly confesseth, that the *Germans* were too hard for the *Romans*, and could not have bin overcome by them, but by the advantage of the weapons and manner of fight; wherein the *Romans* having long continued a civill Nation, had practised themselves: which he secondeth by many instances, drawne from severall conflicts betwixt the *Germans* and the *Romans*, which he might well speake; forasmuch as himselfe reports 210 yeares were spent in the conquest of *Germany*, & no Nation so much troubled them as this; which notwithstanding when all was past, was thought to be triumphed over rather then conquered. It were an infinit task to write all which *Tacitus* relates of the valour and warlike disposition of the *Germans*, being a Nation loving rest, and hating *Idlenes*, punishing cowardice with Death, and reputing it an inexpressible shame for a subject to see his Prince slaine in Battaille, and returne alive without him. As much or more he reports from *Iulius Agricola*, then *Proconsul* of *Britany*, of our ancient *British* Nation, whose factions and dissensions amongst themselves gaue occasion to the *Romane* victory, and not the *Romane* valour wherein he confessed them no way to stand inferior. To strengthen this assertion, History will afford an evidence almost in every corner of the world, wherein we shall find the North by sundry conquests to have prevailed against the South. In the East parts we find that *Gingis Can* a Nor-

therne *Tartar* conquered the *Indians*; That the *Tartarians* also conquered the *Armenians*; and yet the *Armenians* had such advantage against the Southerne people, that the *Mamelukes* esteemed a strong Nation in *Egypt*, were first chosen out of *Armenia*. Also we find that the people of *Cathay* subdued the *Chinois* and the *Indians*. We read also that *Mahomet* a *Saracen Sultan* of *Persia*, hired certaine Northerne *Scythians*, with whose strength he ouerthrew the *Caliph* of *Babylon*, who dwelt afterwards in *Turcomania*. Neither wants *America* many examples in this kind, and no question but many others haue bin drowned in obliuion for want of History. We find that the people of the North in this Continent prevailed against the South, and conquered *Mexico*, which was afterward subdued againe by *Cortese*; and by later discovery of our *English* nation we are giuen to vnderstand that the people about *Terra de Laboradore* are a fierce warlike people, in so much as rather then they would yeeld themselves to be taken captiue by our men, they haue bin seen to make away themselves. To goe no further then our own country, who knowes not how many famous ouerthrowes haue in later Ages bin giuen to the *Spaniards* and the *French*; especially to the later, who haue feared the vtter vndoing of their State: yet neither of these two great Kingdomes could euer attempt any thing against the *English* worthy Chronicle or obseruation: If any man object the actions of King *William* the Conquerour, we can answer many waies: first that he wanne the soueraignty not meere by the sword, but by *Agreement* and composition, challenging a promise from King *Edward* the predecessor, and being fortified with a strong faction of the nobility of the Realme: and moreover the malice of the Subjects against *Harald* being an vsurping Tyrant, gaue great spurres to his victory: wherefore we cannot iudge this a true Conquest: yet hath *England* bin conquered of the *Danes* a more Northerne people, and suffered many inconveniences of the *Scots*, but yet were neuer able to conquer them vterly, or bring them vnder subiedion; although fewer in number, and neare their Confines. Now for the second clause, that the people

ple of the Middle Regiō are more prudent in preservation of Common-wealths is warranted out of the same grounds: for to this two things are necessary, to wit, *Armes* and *Counsell*: whence they vsed to paint *Pallas* armed, to signifie that not onely *strength*, but *counsell* was necessary for the establishment of kingdomes. The *Southerne* people (as we haue shew- ed) being altogether addicted to *contemplation*, haue bin vn- able either to defend themselves, or repell an enemy. On the other side the people of the *North* hauing *strength* sufficient to assault, for want of *prudence* and counsell could neuer long enjoy their Conquests, so that we shall seldome read of any great Empire established of either. But the *middle* people ha- uing strength to subdue the *Southerne*, and policy enough to c- uercome the *strength* of the *North*, haue established many great and famous Empires. Here for an ample example wee may produce the State of the *Romane* Empire, which bor- rowed Lawes and discipline from the *Gracians*, nauticall Sci- ences from the *Sicilians* and *Punicks*, military discipline from their daily exercise: and therefore was it no great won- der, that in state and glory they surmounted all other Nati- ons. On the other side we find many famous victories atchie- ued by the *Northerne* people, yet could they neuer leaue be- hind them any large Empire, but as easily lost as wonne their Kingdomes. Thus fared it with the *Goths*, the *Hunnes*, the *Heruli*, and the *Vantals*, which with so many strong Ar- mies invaded *Europe*, and *Asia*, who neuerthelesse for want of *wisdome* and foresight, could not hold what they got, or settle therein any state of long continuance.

4 The extreame Regions in manners, ac-
tions, and customes, are cleane opposite,
the one to the other. The middle partake of
mixture of both.

That the *manners* of men depend on the naturall complexi-
on and temper, is warranted aswell by experience as appro-
ued testimonie of our best Philosophers. For howsoeuer

grace

grace or education may make a change; yet this is extraordinary, and these raines once loof'd men easily returne to their former disposition: How much the *Northerne* man differs from the *Southerne* in naturall constitution, we haue formerly taught; out of which we cannot but conclude, a great disparity in *manners* and *customes*: Yet to shew a more speciall & euident demonstration, we will make a particular enumeration of such affections as are incident to the *northerne* and *southerne* man, and out of the compariton make our iudgement.

First therefore, it is manifest out of ancient and moderne obseruation, that the *Northerne* man hath bin taxed of too much *levity* and *inconstancie*: The *Southerne* man contrariwise of too much peruerse *stubborneesse*, as well in *opinion* as *affection*. The reason of both we haue before specified, to be their naturall *complexion*: which in the former is inclined to *sanguine*, in the later to *Choller* *Aduſt*, and *melancholy*: whereof the one is the more subiect to *change* or *impreſſion*, then the other. *Galen* deriuing all vertues from the *humours* of the bodie, makes *Choller* the mother of *prudence*, *melancholy* of *constancy*, *blond* of *mirth*, *fleame* of *mansuetude*: Out of the mixture of which *humours*, infinite variety ariseth. And because these *humours* are seldome *equally*, or proportionally combin'd, and temperd together; they become the *sources* of infinite *vices*: Which *Inæquality* of *temperament* is rather found in the extreame regions: And therefore no marvaile if they are observed, to haue bin subiect to greater vices then those of the middle region: For the *mutability* and *levity* of the *Northerne* Nations, we can haue no greater argument then the change of religion: It is written of the *Ostrogothes* & *Visigothes*, that being expulsed by King *Attila*, they besought *Valens* that he would grant them a dwelling place: conditional-ly promising, that they would submit thêselues, as well to the *lawes* of the *Empire*, as to the *Christian Religion*. Which ha- uing obtained, they fled from their promise and perfidiouſly burnt the *Emperour* aliue. The *Gothes*, as soone as they came into *Italy*, embraced the *Christian religion*, but soone ranne into *Arrianisme*: The people of *Groenland* according

ding to *Munsters* relation, being of a *wavering* disposition, soone lik't the *Christian religion*, but soone relapsed to *Idolatrie*. The *Turkes* being a kind of *Scythians*, as soone as they came into *Asia*, without any great constraint, embraced *Mahumetanism*. The *Tartars* likewise, without any enforcement yeelded first to *Christianity*, and soone fell backe to the *Arabian rites*. The *Normans* coming into *France* although very rude and barbarous, rejecting *Gentilisme*, *Paganisme*, subscribed to the *Christians*. As soone or sooner the *Islanders* fell from *Idolatrie* to the true religion. The *Bohemians* and *Saxons* first cast off the *Romane* yoke; which were seconded by all *Saxonië*, the *Cities of the Balticke sea*, *Denmarke*, *Norway*, *Suedia*, *Helvetia*, and *Britanny*. The revolt of these nations from the *Romans* subiection, I cannot tearme *levity* or *inconstancy* in their chiefe leaders and teachers: Being such as vpon long deliberation and mature advice attempted that, which they knew to be most consonant to truth & reason: to whom without doubt God almighty hand was not wanting. But for the *rude* and *vulgar* people to be so soone wonne, and turned from one opinion to another, without longer deliberation, was argument of a *mutable* disposition: Sith there can be no greater token of *Inconstancy* then to make an absolute change of religion in all points in so short a space; whereas the religions being so nearly affined, the one to the other, no man at first sight, out of reason and discourse would embrace or reiect all grounds together, but by degrees: No lesse argument of *levity* in those *Northerne* people, is the distraction and division of them into so many *sortes* and *factions* of Religion, as we find now in *Germany*, *Belgia*, *Polonia*, and else-where, which no doubt at first proceeded from one or few beginnings. But on the contrary side, if we looke on the *Africans* and *Southerne* people, we shall find them as obstinate and perverse in standing to their owne propositions, as ready to tax the *Northerne* people of *levity* and *Inconstancie*. For such hath bin the setled constancie of these nations, as well *Africans* as *Asiaticks*; that no meanes could be invented to draw them from their opinion, but either *heavenly miracles*

or force of armes. Which constancy hath bin apparant, not onely in men but also in women and children: which made *Antiochus* even mad when he by all cruelty tortured the *seven Sonnes* (as we find in the booke of the *Maccabees*) yet was as farre from turning them from their Ceremony of forbearing the eating of *Swines-flesh*, that both the mother invited them, and the Children willingly submitted themselves to Martyrdom. Against this constancy, *Mahomet*, when neither by fained miracles nor persuasion, he saw he could prevail, betooke himselfe to Armes; for the establistment of his discipline which otherwise he could no waies have brought to passe. And it is strange to see the *Jewes* at this day, which being a people disperfed over the face of the whole Earth, groaning vnder the servile yoke of subjection, hauing no King, or supreme gouernour of their owne, haue so obstinately retained their religion, for these three thousand yeares. What shall I speake of the *Mahumetans* in *Africke* and *Asia*; of the *Indians*, the *Chineis* and other Southerne people, which hauing once serled a platforme of Religious discipline, are impregnable against all persuasion, mainely opposing themselves against the grounds of our Religion, hauing not somuch as the principles of nature to support their owne. To let passe the ordinary commerce and traffick, with *Christian* nations, which in so euident a case, might probably beget some fruits; the admired Industrie of the *Iesuites*, erecting their Colleges amongst them, might seeme to promise greater matters. But as I haue credibly bin-enformed, by such as haue trauielled, aswell into *Turky* as *Africke* and *India*, the euent of their labours hath come to faire short of expectation, that they haue by their conference rather engendred a worse opinion of *Christianity*. Which though some may impute probably to their indirect means and superstitious rites, imposing on the conscience, what God neuer commanded, but rather forbad: Yet who so shall obserue the cunning and subtilty of these *Sophisters* will rather ascribe it to the perverse and stubborne disposition of the people, vnapt to receiue any new impression: For else, who could imagine they could be so powerful.

full in perverting and infecting others with their *Romane* superstition in these parts, hauing their *consciencs* better enformed out of *God's* word, and their *understandings* ordinarily better taught, in principles, and euery way more strongly fenced against temptation. As these Southerne nations alwaies boasted of their owne *Constancy* as a prime vertue, so ceased they not to vpbraide the Northerne man with inconstant *levity*. This the *Italians* object to the *French*, and *Germans* (as we finde in *Tacitus*). The *Greekes* heeretofore to the *Italians*, the *Cretians* to the *Gracians*, the *Hebrewes* and *Egyptians* to the *Greekes* and *Cretians*; On the otherside the other haue somuch complained of their perverse and settled *superstitions*. For to iudge indifferently of either, they are both vices declining from that golden *mediocrity*, which we call *Constancy*. For the defect is *leuety*, the excesse *Pertinacy*; and as it is very culpable in any man to turne with euery winde; so it is as great an indiscretion, to be so wedded to our owne *opinions* or *affections* as to turne on no occasion: Because all things vnder the sunne are subiect to change and alteration: And therefore it is the part of a wise man to accommodate himselfe vnto the object, and not in a fond dreame to wrest all the world to his owne fancy. For a wise Sea-man will rather obey the storme then seeke his ruine, and when he cannot recouer the port, will turne to any other point for his owne preservation. I speake heere onely of matters of *state* and *policy*, and not of *religious actions*, other wise then concerne the *externall rites* and *Ecclesiasticall discipline*, the most part of which, by wise men haue bin esteemed no other, then matters *indifferent* which may admit of *change* and *alteration*. But heere some one might object that the *French* of all Nations, haue bin generally taxed of *lightnesse* and *inconstancy*, being notwithstanding in the middle region, more North then the *Africans*, yet more South then the *Germans* or *Scythians*; I cannot altogether excuse them of this *Nationall blemish*, yet with their countryman *Bodin*, I hold it more fitly tearmed *remerity* then *levity*, being a people very quick and agill, aswell in *speech*, as *action* in somuch as the *executions*

of matters with them many times are past, ere the *Spaniard* can enter into *consultation*: for as the *Spanish* counsell is euer *slow*, & full of *delayses*, so is the *French* too *heady* & *hastie*: & as *delay* to the one, so *rashnes* to the other hath *proued dangerous*. The *mediocrity* betwixt both being a *promptitude* or *alacrity* in effecting matters, is to be esteemed as a *virtue*, which we find in the *Italians*, whose action is *quick* enough, yet commonly grounded on sufficient *deliberation*: yet if we compare the two extreames, we shall find the *Spanish* delays to haue *ouercome* the *French hastinesse*, being farre lesse subiect to *errour*, then the other.

Another difference betwixt the *Northerne* and *Southerne* man is discovered in the Affection of *Anger* and *Reuenge*. The *Northerne* man though quickly moued to *anger*, and *very furious*, *prouokes* his enemy to the *open field*, and after a little time is quickly *pacified*, forgetting the *iniury*. The *Southerne* man contrary wise is not so quickly *iraged*, but being once *prouoked*, pursueth his *reuenge* by *secret stratagems*, rather then *open fury*, and will neuer or very hardly be drawne to *reconciliation*: which base and brutish disposition ariseth not so much out of their euill *education* (as some haue imagined) as out of *melancholy* ill tempered. A prooofe whereof we haue in most men amongst vs, of a *melancholy* disposition, which according to our common *prouerbe*, threaten danger and hatred *implacable*: of this disposition were *Ajax* and *M. Coriolanus*, whereof the former for want of *reuenge*, in a *distracted fury* fell on the *heards* of *cattle*: the other would by no meanes be *reconciled* to his *Countrymen*, till he saw all their *Cities* in *flames*. Of the *crueltie* of the *Africans* many *histories* haue giuen *testimonies*, especially *Leo Afer*, speaking of the *Carthaginian* *dissention*: and with later *Writers* most memorable is the story of miserable *Mulleasses* deposed of his *Crowne*, his eyes burnt out, and his face *disfigured*, tending his complaint to the Emperour *Charles*. This *crueltie* hath no lesse bin observed in the most *Southerne Americans*, with whom it is a *custome* to bathe their children in the *bloud* of their *slaughtered enemies*, to drinke their *bloud*, and banquet with their *carnes*.

cases : And if we examine the originall of *tortures* and *severe lawes*, we shall find them originally deriued frō the Southerne people, which the Northerne Man hath seldome vsed but unwillingly in matters of horrib'e treason. And not without good reason haue our Lawes taken other courses for the conviction of malefactors in cases of felony and murder, then the extortion of *confession* by extreame *tortures*, a thing comon with the *Italian*; because (as some of our *Statists* haue obserued) our Nation is by nature more apt to confession without torture, and so fearefull of torment, that they will more willingly be brought to the *block* or *gallows*, then the *rack*; whereas the *Southerne* people being by their *melancholy* temper more fearefull of death, and obstinate in their opinion, will yeeld rather to the greatest *torture* then *confession*.

Thirdly we shall find as great a disparity betwixt the *Northerne* and *Southerne* man in the *stuttish carelesnesse* of the one, and the cleanly *neatnesse* of the other. *Tacitus* reports of the old *Germans*, that they liued at home in their houses in sordide manner almost naked, and that they vsed the same *roomes* as receptacles as well of their beasts as of themselves: which custome we shall not find much changed amongst some, if we read *Lipsius* speaking of the *Westphalians*, or haue so much patience elsewhere to make experiment. It is also reported that the *Scythians* whensoever they found themselves oppressed on the way, or in the warres by hunger or thirst, were wont to open a veine vnder their horses eares, and to suck out their bloud, and to banquet with the *flesh*, as we read of *Tamerlane's Army* on the like occasion: but the *Southerne* people are of a neat and cleanly disposition, abhorring all *sordide* & vncleanly action, vsing often *bathings* & washings, not only in sacred and Ecclesiasticall matters, but also in *private*. And therefore no wonder if (as *Xenophon* among the Ancients reports) that amongst the *Persians* it were accompted a very vnmanly thing to spit; or that amongst the *Abyssines* (as *Aluarez* writes) it should be deemed a most hainous and flagitious crime, to drop any *spittle* or *spittle* in any of their *temples*. An argument of this may be their extraordinary affection of *neat* &

dainty *delicates*, which (as *Atkenau* relates) is most noted in the *Asiatickes* and *Egyptians*, by which meanes *M. Anthon* a luxurious spend-thrift, finding himselfe by *Cleopatra* surmounted, he smiled at his own ambition in that kinde, and laughed at the *Romans* his own Nation as ignorant and barbarous. Of the *Persian Theophrastus* writes, that by a certain Law certain great rewards were promised to such men as had invented any new kindes of *Delicates* or pleasures, which is a great argument of the licorous affection of this Nation. A fourth difference may be discovered in the conversation of the *Northerne* and *Southerne* Man For the *Scythian* and *Northern* man is naturally addicted to company and society, as may appear by the communion of many men in one place in the fields, who amongst the ancients were tearmed *Nomades*, and are now called *Hordes*; in which manner the *Tartars* liue at this day: also it is well knowne how much the *Germanes*, *Brittaines*, *Danes* are addicted to company, insomuch as they can hardly liue long without companions. But the *Southerne* man being (as we haue proued) of a *melancholy* disposition, chuseth rather to liue solitary, and to lurke in woods and desarts, then amongst people: Neare to which nature come the *Italians* and *Spaniards*, who affect rather a retired *Gravity*, then an open society, and converse but at a distance, rather for formality then friendship. 5^{ly}, no lesse disparity in the disposition of the nations shall we find aswel in the *Languages* they ordinarily vse, as the kinds of *musick* which they affect: for the former we may generally obserue in the *Northerne* Languages a rough collision of *consonants* and aspirations, as in the *German* and *Bohemian* Tongues. Neither is this obserued only in their native Tongues, but also in their vse of the *Latin* Tongue, in pronunciation of which they cannot but mixe rough aspirations; as I haue obserued oftentimes in the *Northerne Germans*, who commonly pronounce *firum* for *virum*; *fulgu* for *vulgu*, *Pipi* for *bibi*, with diuerse other of the like nature: as vnable they are on the other side to giue any soft aspiration his due sound, but commonly leaue it out altogether, or pronounce either the *vocales media* for *vocales reuues*, and *aspirata* for *media*, which proceeds

proceedes altogether from the immoderate strength of *heat* & force of the *spirits*. But the *Southerne* people contrarywise wanting that degree of *heat*; in their pronounciation abstaine from these hard *aspirations* and collision of many consonants together, without vowels to mollifie the harshnes; as we find in the *Greeke*, *Latin*, *Spanisk*, and *Italian* tongues, which lye nearer to the South. Also the *Turkish*, *Arabian*, and *Persian* tongues are by such as are experienced in them, said to be *sweet*, and *elegant*. Also it is to be noted, that as often as the Colonies of the North haue invaded the South, although retaining the same *foote-steps* and *originall*, haue notwithstanding much altered their *pronounciation* not only through the *mixture* and impression of other *languages*, but also through the *nature* of the *place*, as we find the *Gotish* tongue of the *Spaniards* to be changed to a smoother and sweeter pronounciation, then that which is retained in *Scythia*. I speak not of the *Latin* mixture, but of the meere *Gotish* words, which we shall perceiue mollified with more vowels, and set to a sweeter termination. The like may be observed in the *Hebrew* tongue, which (as *Iosephus Abudichnon*, sometimes a Reader in this Vniuersity obserued) to the eare sounded farre sweeter in the *Arabian*, *Turkish*, and *Persian* dialects then it's owne originall; not that it is in them more perfect (which were impiety to beleeue) but because men in *pronouncing* of a language preferring *pleasure* before *significancie*, haue mollified it, with soft vowels and aspirations, rather to serue the *care* then *understanding*. No lesse affectation shall we find of diuerse sortes of *musick*, sorting with their diuerse dispositions. The *Northerne* mans humour consortes best with the *Phrygian* measure, a *loud* and *stirring* harmonie: The Southerne man hauing his spirits more mollified affects the *Lydian*: The people of the middle region, are most of all delighted with the *Dorick*, a musick heretofore vsed in *sacred* exercises. They who know these measures exactly, and which is agreeable to this or that mans fancy, will giue a probable guesse vnto his naturall disposition. To runne over all the differences in manners and customes of the *Northerne* and *Southerne* nati-

ons were a matter infinite; wherefore it shall suffice to wrap vp all in a generall recapitulation. If we compare the *Northerne* man with the *Southerne*, we shall find the one *white & red*, the other *black or tawney*; the one *big-boned*, the other *small and dwarfish*; the one *strong*, but *easie to be deceiued*; the other *weake*, but *witty and circumspect*: The one *giuen much to wine*, the other *exceeding sober*; the one *neglecting both himselfe and others*; the other *carefull and ceremonious*: The one *rustically arrogant*, the other *high minded*; the one *prodigall*, the other *parsimonious*: The one *temperate*, the other *lecherous*; the one a *sloven*, the other *neat and handsome*; the one *plaine and simple*, the other *craftie*; the one a *soldier*, the other a *Priest*; the one a *workman*, the other a *Philosopher*; the one standing on the strength of his *hands*; the other of his *wit*.

Out of the mixture of these extreames, it is no difficult matter to draw the disposition of the middle Nations. For finding the two extreame nations of the *North* and the *South* to be not onely diuerse, but for the most part opposite one to the other, in disposition and manners; it were very rationall to iudge the *middle* to haue a mixture of both, which observation will also approue: For if we compare the *middle* region with either the *extreames*, we shall find no such apparant diuersitie, as betwixt the extreames themselves. Heere *Monsieur Bodin* dreames of a golden *mediocritie* to magnifie his owne Countrie, which he finds in his middle region. For sithence both these extreames challenge an extremitie of disposition, he imagines this middle tract onely reserued for *vertue & temperance*. But if he iustly weigh all in the ballance of impartiall *iudgement*, he shall finde no such advantage. For first out of his owne grounds, to which we haue hitherto assented, he ascribes to the extreame nations an eminencie both of vice & vertue: Then cannot the middle challenge these qualities otherwise then *remitted*, and of lesse force. If therefore he would haue their inclination to *vice* more moderated, and corrected; he must also confesse their disposition to *virtuous* actions to be of lesse validity. Again these middle nati-

ons are to be accompted either *directly* situate betwixt both the extreames, or more inclining to the one then the other: For these *directly* in the *middle*, we must imagine them to partake of both dispositions, as well to *vice* as to *virtue*, borrowing from either extreame as well *good* as *bad*: Heere therefore can be found no disadvantage: For if they will boast of the *virtues* of either, they must likewise be ashamed of either *vices*: If they plead a moderation of the *former*, they must loose so much reputation in the *later*. For these which more nearely incline to the one then the other, it will be apparant that as they approach the *one* in *one* quality, so they are farther off in *another*: as if they approach nearer in *contemplative* wit to the *Southerne* people, so will they come so farre short of the *Northerne* valour. For by how much more they come neare the *virtue* of the one, so much come they short of the others Affections. The like may be judged of their Imperfections; so weighing reason with reason we shall find no such inequality and disproportion to magnifie the one, or vpbraid the other: for that Almighty Creatour of all things is wont to distribute his blessings in proportion: & *Nature* his soueraigne hand-maide triumphes in nothing more then variety. Thus haue we spoken as farre as *history* and *observation* can iustifie of the *lawes*, *customes*, and *manners* of the *Extreame* & *middle* Nations, in which we haue chiefly tied our discourse to the *Northerne* and *Southerne* people in this Hemisphere, hauing few *histories* to leade vs to the consideration of the other opposite on the *Southerne* Hemisphere: yet the causes being like, we may out of the former be able to giue a iudgment of the *later*.

8 Hitherto haue we treated of the people of the *Northerne* & *Southerne* Hemispheres, with the speciall subdiuision of each into *Extreame* or *middle*: It now remaines that we speake of the diuision of Inhabitants

according to the *Longitude*.

- 9 According to the *Longitude*, Inhabitants are either in the *Easterne* Hemisphære, or *Westerne*. Those I tearme of the *Easterne* which liue betwixt the *Canaries* and the *Molucco* Islands on this side: The *Westerne* those which dwell betwixt those two on the other.

These two Hemisphæres of the Earth haue by some bin called the *Old* and *New* world; because the former containing *Europe*, *Asia*, and *Africk*, hath bin knowne to the ancients as the portions of *Noah's* threë sonnes, *Shem*, *Ham*, and *Japhet*, whereof (as the Scriptures testifie) *Shem* had *Asia*, *Japhet* *Europa*, and *Ham* *Africa*. The other containing *America* the *South*-continent, and some other *Islands*, haue bin since discovered. Of the comparison of the Inhabitants of these two Hemisphæres we will insert this Theoreme.

- I The people of the *Easterne* Hemisphære in Science, Religion, Civility, Magnificence, and almost euery thing els, are farre superiour to the Inhabitants of the *Westerne*.

For demonstration of this point we need not spend much time; first it is manifest that this Hemisphære was peopled a long time before the other, which is a probable argument of their culture and civility: because all these matters haue commonly their growth and perfection with time the mother of all perfections. That this part was peopled a long time before the other, is most credible: for it is plaine out of the holy Scriptures, that the first off-spring of mankind was in *Asia*; whence it could not disperse it selfe into *America* and other parts of the

the *Earth*, till such time as their populous growth had required larger bounds. The passage from *Asia* into *America* without doubt had bin performed either by sea or land. By Sea it was improbable they should adventure in that infancy of the World, when the Art of Navigation was in her swathing bands, and neither the *Chart* or *Compass* as yet invented. If by land they made their passage, it was doubtlesse through the North of *Asia*, supposing *America* with *Asia* to be one Continent. But this people coming out of a pleasant and temperate Country, would without question first attempt the places of the like quality, as most pleasing their eye, and fitting their disposition, before they would inforce their passage to the *Icy* and frozen Climate of the North, which can only be beholding to necessity for habitation. Hence without doubt it came to passe, that those Nations wandering farre from their first fountaine, and leauing no sufficient monument to instruct their posterity in their first *originall*, came short of the other, as well in revealed as acquired knowledge: in revealed knowledge, either sought in *Holy Scriptures*, or *Traditions*, they could not but come short, as being most distant from the first head and fountaine where it was to be found in greatest perfection. In *Acquired* knowledge gotten by industry and experience they could not come so farre as the other; because all such knowledge hauing it's beginning from obseruation, and it's growth with age, could not be brought to that perfection amongst them, who came more lately to be a people, and scarce euer endowed with any settled gouernment: but whatsoever the causes may be thought of this diuersity betwixt the people of the *Westerne* and *Easterne* Hemispheare, certaine I am that the effect it selfe is most apparant. Of the happy endowments of *Europe*, *Asia*, and a good part of *Africke*, both in *Arts* liberall and mechanickall; *state*, *policy*, *magnificence*, and *Religion*, we haue often spoken, and neede make no repetition. To this if we compare *America*, being (as it were) the only portion of this Hemispheare, we shall amongst them find few or no *Arts* either *invented* or *taught*, the vse of *letters* scarce euer knowne; *state* and *magnificence* little regarded, and the

Light of *Christian Religion* scarce euer scene, or at least through the dimme clouds of *Roman superstition*. He that would know more in this matter, let him read *Peter Martyr*, *Cortesi*, *Acosta*, and others, of the naturall disposition of the people of *America*.

10 The Inhabitants of such Hemispheres are againe subdivided into the *Easterne* and *Westerne*: the *Westerne* in the *Easterne* Hemisphere, are they who liue nearer the *Canaries*: the *Easterne* are such as are situate towards the *Moluccoes*: to which those other in the *Westerne* Hemisphere are correspondent.

1 The *Westerne* people haue bin obserued to be more happy and able in martiall discipline: the *Easterne* in witty contemplation, & *speculative Sciences*.

There is no small affinity (as we haue before touched) betwixt the *West* and the *North*, as betwixt the *East* and the *South*; aswell in the temperament of the Aire, as the disposition of the Inhabitants: which cognation will appeare more fully by the prooffe and demonstration of this Theorem. Of the strength and valour of the *Westerne* people, many records giue euidence; we read of innumerable Colonies of the *Celtes* a people situate on the *West* of *France*, sent into *Italy*, *Greece*, & *Asia*. But the *Italians* durst neuer invade *France*, till such time as their Empire was at the height vnder *Cesar*, taking also advantage of the home-bred enmitie of the Inhabitants among themselves; whence *Tully* the Orator tooke occasion to praise *Cesar* for subduing those Nations, and reducing them to the *Romane* obedience, whose strength the *Romane* Empire could hardly sustaine. The *Italians* haue oftentimes molested the

Gracians, yet from them suffered little or small inconveniences: so the *Gracians* hauing with their Armes cut out a large way through *Asia*, scarce euer dared to come into *Italy* but once vnder the conduct of *Pyrrhus*, who being almost defeated of his Armie, was inforced to saue himselfe by flight. In like sort *Xerxes* who brought men enough into *Greece* to dry vp the Rivers, was notwithstanding defeated by a few *Gracians* to his great dishonour. Wherefore *Cato* had good reason to object to *Murea*, and *Cesar* to *Pompey*, that their warres waged against the People of *Asia* in respect of others were (as it were) rather against *women* then *men*. This without doubt gaue *Alexander* his greatest happines and victory, that he turned his Armes against the *Easterne* people, which were either altogether *barbarous*, wanting martiall discipline, or all ouer delicate, not able to resist such hardnes: whereas if he had opposed the *Westerne* people (by the censure of *Livy*) he had at least failed of those many Conquests, if not purchased a fatall ouerthrow. The obseruation perhaps of which couragious valour in the *Westerne* people was the cause why the *Turkes* heretofore were wont to chuse their *Ianifaries*, and chiefe men of warre out of the *Europaans*, accompting them more strong and able then the *Asiaticks*, being of temper more soft and delicate. To this accords *Iulian* in his booke against the *Christians*: the *Celtes* (saith he) are *Bold* and *Aduenturous*: the *Greeks* and *Romans* both *warlike* and *ciuill*: the *Egyptians* more *industrious* and *subtle*, although *weake* and *tender*. The *Syrians* with great alacrity conforme themselves to discipline: And a litle after hath these words: What shall I declare (saith he) how covetous of *liberty* and impatient of *seruitude* the *Germans* are, how *quiet* and *tractible* the *Syrians*, *Persians*, *Parthians*, and all the Nations situate towards the *East* and *South* parts of the World. *Tacitus* reports, that the *Batavians* lying on the West of *Germany* of all the *Germans* are the strongest & most valiant: which *Plutarch* also confirms in the life of *Marinus*, that the most warlike people of all *France* are these which are most *Westerne*. The like opinion had *Cesar* of the *Westerne* Nations: of all the people of *Europe* (saith he)

the *western* people of the *Brittaines* and *Spaniards* are the strongest. Now as the *western* people iustly challenge to themselves this prorogative of *strength* and *valour*, so must they yeeld to the *Easterne*, that of *Religion* and *contemplation*. To let passe the *Indians*, which a long time gone, were enriched with knowledge, if we beleue ancient writers; who can deny the *Hebrewes*, *Chaldeans*, *Syrians*, *Egyptians*, *Arabians*, and others of the *East* their iust trophies of *learning* and *contemplation*, which they haue erected to after ages. From these fountaines haue the *Greeks* and *Latins* derived those large streames, wherewith they haue (as it were) watered all *Europe*. It is written, *That there came wise men from the East to worship Christ*; which must needs be vnderstood of *Chaldea* or the places neare adioyning, where the *Magi* or *wise men* were had in great reputation. If any object the decay both of *learning* and *religion* at this day, in the *easterne* parts of the world; We answere that this in most parts is meerely *Accidental*, caused by the *hostile* invasion of the *usurping Turkes*, which professe themselves to be vtter enemies to *learning* and the true *religion*. To which, we may adde the ignorance of the *Christian* religion in many places, which is the greatest ground of solide knowledge. For amongst all religions in the world, there is none which giueth more way to *learning* then the *Christian*: Whereas some others altogether forbid the studie of such matters; yet is not this inclination so absurde in the *Easterne* people, but that euery-where some *markes* and *footesteps* will discover their disposition. For in the *East* shall we find no small number of *Christian Churches*, and *Monasteries* professing *Christianity* and other good *learning*. But to speake no more of the *Christian religion*, which we hold rather by *Gods* speciall *grace*, then nature: the *superstitious* devotion of these heathen nations to their owne *false religions*, is a sufficient argument of their naturall inclination to *religious* exercises. How obstinately *perverse*, *Ceremonious*, and *superstitious* the *Indians* are found in *Idolatrous* religions, I haue often wondred to heare some *travaylers* reporte: Of the other *Hemisphere* comprehending

ding *America*, I haue as yet small evidence out of *Historie*, whereon to ground any certainty; all we can say shall be comprized in this Theoreme.

2 *The easterne part of the westerne Hemisphære was peopled before the westerne.*

This proposition seemes probably warranted, aswell by reason as authority; for first, supposing as an infallible ground, that the first offspring of all nations was in *Asia*, towards the *East*; it must needs follow, that to people *America*, there should be a passage therevnto out of *Asia*; because *America* was a long time not inhabited ere it was discovered to the *Europeans*. This passage then, was either by *sea* or *land*. Were it by *sea*, the first part whereat they could arriue was the easterne side. If we suppose it to be by *land* (as is most likely in those ancient times) yet was it most probable it should be on the *North-east* side from the *Pole*, because it is found by obseruation that on the *North-west* side it is diuided from *Asia* by streites; then must they first touch on the *Easterne* part. To this we may adde the experience of the *Castilians* and *Portugalls* (who first discovered this part), who affirme that the people dwelling on that side, haue bin obserued to surpass the *westerne* by farre in ciuility of manners, knowledge, and such endowments, which may be an argument of the antiquity of their plantation.

C H A P. XV.



The second diuersitie of disposition of inhabitants ariseth from the diuerse nature of the *Soile*.
Heere fowre distinctions of Nations are remarke-

remarkable. 1. of the inhabitants of the *Mountaines and plaine-Countries*. 2. of *marish and dry*. 3. of *windy and quiet*. 4. of *sea-borders and Inland people*.

That mens dispositions are diuersly varied according to the temper of the soile, euer mans owne experience may easily enforme him; for to reserue peticular instances to their proper places, it is most manifest that all the vitall operations of the *soule* depends aswel vpon the *corporeall* and *organicall* parts, as the *Spirits*; which being diuersely affected by the qualities of the *Aire*, and *Earth* must needs vary and suffer a change. Plaine and evident disparity is found: first betwixt two nations situate in the same *Parallel* or *climate* in respect of the heauens. Secondly betwixt two men borne in seuerall *Countries* liuing together for some time, in the same region. Thirdly, of *one* and the *selfe-same man* liuing at diuerse times in diuerse regions. Fourthly, of a man liuing in the same Contry at diuerse seasons and times; all which being heeretofore demonstrated will declare vnto vs the great *Sympathie*, and *operation* the *Aire* and his diuerse qualities, hath with, and on our corporeall *Spirits* and *organs*. But the temperament of the *Aire* (as we haue formerly shewed) depends on the temperature of the soile: whence it must needs follow that the naturall disposition of men should be varied somewhat in respect of the *soile*. This disposition of the *soile* being monifold, we haue reduced onely to three heads: leaving other curiosities to such, as haue more leasure: What we iudge in this, shall be declared in these Theoremes.

1. *Mountaine people are for the most part more stout, warlike and generous then those of plaine countries: yet lesse tractable to gouernment.*

Of the warlike disposition of the *mountainists* and their strange

strange *Impatience* to *subjection*, many Histories giue testimony. Geographers report, that setting aside the people of the North (to whom for *strength & valour* we haue giuen the palme,) the Inhabitants of the mountaine *Atlas* are great and strong, out of whom the Kings of *Namidia* and *Mauritania* in time of warre are wont to levy their forces. And it is worthy admiration to consider the mountaine people of *Arabia*, who could neuer be drawne to yeeld to subjection, but being fortified not somuch by the benefit of the place (as some might happily imagine) but rather by naturall strength and valour, haue alwaies liued in liberty. To whom (as is reported) the *Turkes* giue a yearely stipend to keepe them off from invading the Territories of *Palastine* and *Damascus*. Of the *Marsians* the ancient Inhabitants of the *Appenine* mountaines in *Italy*, the *Romans* were wont so well to conceiue, that it grew into a proverbe: *Sine Marſis triumphasse neminem*. *Gostane*, when he went about to invade the kingdome of *Suecia*, chose his legions of soldiers, out of the *Dalecarli*, who inhabite the *Succian* mountaines. But amongst all, no nation hath purchased a greater opinion and reputation then the *Heluetians*, living amongst the *Alpes*. These men are originally descended from the *Succians*, which for valour, haue so farre approoued themselves, that they haue not onely kept themselves free from forraigne iurisdiction, but haue often deliuered their neighbouring countries from slavery & oppression. Against the house of *Austria* they haue not once displayed their banners, and triumphed in their overthrow. A great part of *Germany* hath smarted vnder their valour; and such an honorable opinion haue they wonne, that they are accompted (as it were) the *Censors* and *moderators* to decide controuersies in matters of state and kingdomes. *Cicero* giues great commendations of strength to the *Ligurians* inhabiting the mountaines: It is well knowne how long and tedious warres the mountaine *Cilicians* and *Acroceraunians* had with the *Turkes*: how long with small damage they endured affront, & droue them back. Here we might add the examples of the *Biscanes* and *Cantabrians* in *Spaine*, who vnder

der the conduct of *Pelagius* their King, withstood the *Saracens*, and preserved both their *language* and *religion*. The like ought be spoken of the *Welch* and *Cornish* people amongst vs, as of the *Scottish Highlanders*: all which living in *mountainous countries* haue withstood the violence of forraigners, and for many yeares preserved their owne liberty. And howsoever it may be objected that the advantage of the place gaue them courage, yet can we not deny their disposition due commendation; hauing not only thus for a time protected their owne rights, but made many hostile invasions on their enemies. Hence *Bodin* would make a certaine *Harmony* betwixt the *mountaine* people, and the *Northerne*, esteeming the inhabitants of the *Alpes*, the *Pyreneans*, the *Acroceraunij* the inhabitants of *Hemus*, *Carpathus*, *Olympus*, *Taurus*, *Stella*, *Caucasus*, *Imaus*, with diuerse others of the same nature, albeit situate in the *temperate* part, to bee accounted *northerne* people: as also farther towards the *South*, the inhabitants of *Atlas*, of the *Arabian mountaines*, of *Pirus* and *Seyaleona*, are (as it were) by him excepted from the *Southerne* inhabitants, in regard of their *high* and *mountainous situation*; which recompenseth the other, and challengeth as much cold, as by the heavens it should seeme to receiue *heat*. This conceit of Monsieur *Bodin*, I admit without any great contradiction, were he not ouer peremptorie in ouermuch censuring all *mountainous* people of *blockishnesse* and *barbarisme*, against the opinion of *Auerroes* a great writer; who finding these people neerer *heauen* suspected in them a more *heauenly* nature. Neither want there many reasons, drawne from *nature* and *experiment*, to proue *mountainous* people, to be more pregnant in *wit* and *guists* of *vnderstanding* then others, inhabiting *low* and *plaine* Countries. For howsoever *wit* and *valour* are many times diuided, as we haue shewed in the *northerne* and *southerne* people, yet were they neuer somuch at variance, but they would sometimes meete. First therefore what can I speake more, for the witty temper of the *mountaine* people, then their *cleare* and *subtile* *Aire* being farre more purged and rarified, then that in *low* countries: For holding.

holding the *vitall spirits* to be the cheifest instruments in the soules operation, no man can deny but they sympathrie, especially with the *aire* their cheifest foment. Euery man may by experience find his *intellektuall* operations more vigorous in a *cleare* day, and on the contrary most dull and heauy when the *aire* is any way affected with foggy vapours. What wee find in our selues in the same place at diuerse seasons, may we much more expect of places, diuersely affected in *constitution*. A second reason for the proofof our assertion, may be drawne from the *thinne* and *sparse* diet, in respect of those others. For people liuing on *plaines*, haue commonly all commodities in such plenty, that they are much subject to *surfetting* and *luxurie*, the greatest enemy and vnderminer of all *intellektuall* operations. For a *fatt belly* commonly begets a *grosse head*, and a *leanne* braine; But want and scarcity the mother of frugality, invites the mountaine dwellers to a more sparing and wholsome diet. Neither growes this conuenience onely out of the scarcity of viandes, but also out of the nature of the diet. *Birds*, *Fowles*, and *Beasts*, which are bred vpon *higher* places, are esteemed of a more cleanelly and wholsome feeding, then others liuing in *ferndes* & foggy places: And how farre the qualitie of our diet preuailes in the alteration of our *organs* and *dispositions*; euery naturalist will easily resolve vs. A third reason may be drawne from the *cold Aire* of these mountanous regions, which by an *Antiperistasis* keepes in, and strengthens the internall heat, the cheife instrument in *naturall* and *vitall* operations. For who perceiues not his *vitall*, and by consequence his *intellektuall* parts, in cold frosty weather to be more strong and vigorous, then in hot and soultry seasons, wherein the spirits are more diffused and weakned. This disparity in the same region, at diuerse times, in regard of the disposition of the *aire*, may easily declare the disparity of diuerse Regions, being in this sort diuersely affected. A fourth reason may be taken from the customary *hardnesse*, wherevnto such people inure themselves from their infancy; which (as *Huarius* proues) begets a better temper of the braine, in regard of the wit and vnder-

standing; which we happen to find cleane otherwise with them, who haue accustomed themselves to *delicatnesse*. These reasons perhaps would seeme onely probable, and of no great moment, were they not strengthened with *forraigne* and *Domesticke* obseruation. Haue not the *Helvetians* situate amongst the mountaines, giuen sufficient testimony; especially in the infancie of our *Reformation*? Haue not the *Sueuians* & *Silesians* shewed themselves able enough, to wipe off the blot of a blockish disposition; yet hauing a situation wilde & mountanous? Had that great Doctour *Reulin* judged well of the nature of such people, he would not haue made it so great a wonder as he did, that wilde *Sueuia* should produce such learned Men. Forraigne instances elsewhere wherein all histories abound, I forbeare to relate; desirous rather to be accompted deficient then tedious. Should I draw home to my native *Westerne* Confines, to which I owe my breath, I should perhaps by some be taxed of partiality or affectation. Should I mention our ancient *Brittaines*, inhabiting the Mountainous Country of *Wales*, or the greatest part of the *Scottish* Nation, injoying the like condition of life, and disposition of the Soyle; I might at once winne loue, & stirre vp envy. Neuerthelesse, as a man by nature borne carelesse of *Detraction*, yet in most respectiue of *Friendship*, I had rather venture my credit, then prejudice the truth: betwixt both which with me the choice is easie. Mine owne Country of *Deuon*, which duty commands me to make the first Instance, I had rather set on the stage of Envy, then Dishonour. I am not of the opinion of the vain-glorious *Creekes*, who boasting too much of their owne perfections, esteemed all Nations els *Barbarians*. Yet to check *M^r Bodin's* bold conjecture, out of which he could finde but one *Anacharsis* in all *Scythia*; I will demonstrate that our mountainous Provinces of *Deuon* and *Cornwall*, haue not deserued so ill, as to be so sharply censured for *Blockishnesse* or *Incivility*. Barren Countries haue bin known to nourish as good wits, as *Bodin*, *Aristippus* the *Philosopher*, *Callimachus* the *Poët*, *Eratosthenes* the *Mathematician*, haue not bin ashamed to call *Cyrene* in *E-*

gypt their native Country, a *Mountainous* and *Rocky* Region. Neither can it be stiled our reproach, but glory, to draw our off-spring from such an Aire which produceth wits as eminent as the Mountaines, approaching farre nearer, to Heauen in Excellency, then the other in hight transcend the Valleys. Wherein can any Province of Great *Brittaine* challenge prece-
dency before vs? Shou'd any deny vs the reputation of *Arts* and *Learning*; the pious Ghosts of *Jewell*, *Raynolds*, and *Hosker*, would rise up in opposition; whom the World knowes so valiantly to haue displayed their Banners in defence of our *Church* and *Religion*. Should they exclude vs from the reputation of knowledge in *State* and *politick* affaires? who hath not acquainted himselfe with the name of *S^r William Petre* our famous Benefactor, whose desert chose him chief Secretarie to three Princes of famous memorie? Who hath not known or read of that prodigie of wit and fortune *S^r Walter Ram-
leigh*, a man vnfortunate in nothing els but the greatnes of his wit & advancement? whose eminent worth was such, both in *Domestick* *Policie*, *Forreigne Expeditions*, and *Discoveries*, *Arts* and *Literature*, both *Practick* and *Contemplatine*, which might seeme at once to conquere both Example and Imitation. For valour and chivalrous Designes by *Sea*, who reades not without admiration the Acts of *S^r Francis Drake*, who thought the circuit of this Earthly Globe too litle for his generous and magnanimous Ambition? Of *S^r Richard Grenvill*, who vndertaking with so great a disadvantage, so strong an Enemy; yet with an vndaunted Spirit made his Honour legible in the wounds of the proud *Spaniard*: and at last triumphed more in his owne honourable Death, then the other in his base conquest? Of *S^r Humfrey Gilbert*, *S^r Richard Ham-
kins*, *Davies*, *Frobisher*, and *Capt. Parker*, with many others of worth, note, & estimation, whose names liue with the Ocean? In the Catalogue of able and worthy Land-Souldiers, whose eye would not at first glance on my Lord *Belfast*; who lately deceased to the great griefe of his Countrey, because in such a time which most requires his assistance? *Courage*, & *Wisdom*, which are often at odds, and seldome meet, in him shooke

hands as friends, and challenged an equall share in his perfections. His wise managing of his affaires in *Ireland*, so well commends his owne *Loyalty*, and his Masters choice, that the whole Realme may truly be said for the most part to owe her present Peace to his Industrie. Should I speake of Generous *Magnificence* and Favour of *Learning*, shewed by Heroicall Spirits in the generall Munificence extended to our whole Vniuersity; what Age or Place can giue a Parallel to renowned *Bodley*, whose name carries more perswasion then the tongue of the wisest Oratour? His magnificent Bounty, which shewed it selfe so extraordinarily transcendent, as well in erection of his Famous *Library*, which he (as another *Ptolomy*) so richly furnished, as other munificent Largesses, exhibited to our *English Athens*, was yet farther crowned by his wise choice, as proceeding from one, who being both a great Scholler, and a prudent Statist, knew as well how to direct as bestow his liberality. If *Founders* and *Benefactors* of priuate Colleges may find place in this Catalogue of Worthies, the sweet hieue and receptacle of our *Westerne* wits can produce in honour of our Country a famous *Stapledon* Bishop of *Excester*, and worthy Founder of *Exon Colledge*: whose large bounty was afterward seconded (next to *Edm. Stafford* Bishop of *Salum*, a *Westerne* Man) by the pious charge and liberality of *Mr John Periam*, *Sr John Acland*, & very lately by *Mr D^r Hakewill*, whose worthy Encomium, I (though vnwillingly) leaue out, lest I should seeme rather to flatter then commend his Worth. But what needes he my poore mention? His learned works published to the World, & his Pious Monument bestowed on our House, speake in silence more then I can vtter out of the highest pitch of Invention. To all which I might adde *Mr Nicholas Wadham*, whose liberall hand hauing augmented the number of our Colleges with an absolute and compleat Foundation, hath left Muses enough to preserve his Name vnto eternity. Had I the like priuiledge to mention the liuing as the dead, we should not finde wanting out of the ashes of these generous *Heroes* of our *Devonian* confines, many genuine and worthy *Sonnes* standing vp in their Fathers places, to shew the world

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a succession aswell of wits as times. There would appeare at once vpon the stage our famous Dr *Sutcliffe*, the worthy *Dean of Excester*, whose magnanimous indeavours, aswell in his learned conflicts with our pernicious *Romanists*, as in erecting a College to oppose our sworne enemies, the *Iesuites*, will (no doubt) lengthen out the end of his declining age with Fame and Immortality. I could offer to your admiration the Worth and Workes of our renowned *Rector*, Dr *Prideaux*, His Majestyes learned Professour of Diuinity in our Vniuersitie, in whom the Heroicall wits of *Iewell*, *Raynolds*, and *Hooker*, as vnited into one, seeme to triumph anew, and threaten a fatal blow to the *Babylonish Hierarchie*: Insomuch that he may iustly challenge to himselfe that glory, which sometimes *Ovid* speaking of his own Country;

Mantua Virgilium laudet, Verona Catullum,

Romana gentis gloria dicar ego.

Mantua Virgil, Verone Catullus praise,

I will the glory of the Romans race.

Neither want the Lawes of our Land, out of this one source, sufficient propps to defend their Countries & the Kingdomes right. The admired sufficiency of *Iustice Doddsdye*, testified to the world by so large a report, and expressed in his incomparable skill in the Lawes (besides his indowments of Arts and other Learning, seconded by the deserued Fame of Mr *William Noy*) can hardly scape my pen, being so deeply dipped in the midst of my Natiue Countrey. I care not what envy I stirre vp in others, so my Mother *Excester Colledge*, which sometimes cherished in her bosome these two worthy Darlings, and since found her curtesie returned back with interest, indulgently permit me this liberty.

Besides these choice floures cropt from our *Hesperian* garden, no question but many more would be found out aliuie or dead; whom fame, if not iniurious, cannot suffer to sleepe without deserued memory. I haue hitherto touched such eminent wits and persons, of whom for their protection sake the Church or *Common-wealth* haue greater reason to take especiall notice. Many inferiour faculties are yet left where-

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in our *Devon* hath displayed her abilities aswell as in the former, as in *Philosophers*, *Historians*, *Oratours*, and *Poets*, the blazoning of whom to the life, especially the last, I had rather leaue to my worthy friend *M^r W. Browne*; who as he hath already honoured his countrie in his elegant and sweete *Pastoralls*, so questionles will easily bee intreated a little farther to grace it, by drawing out the line of his *Poeticke* Auncesters, beginning in *Iosephus Iseanus*, and ending in himselfe. *Bodin* perhaps might oppose against vs the eminency of his *Parisian* territory, as some with vs the glory of our Metropolis and Vniuersities, disdaining all comparison: But to this it is not hard to shape an answere, 1 That a Metropolis or Vniuersity is to be imagined as a common receptacle of the most selected wits deriued rather from other places then the temperament of their owne Aire: Insomuch as they may be said to owe their abilities, for the most part, to those to whom they owe their wealth. Neither can they challenge a greater interest in this glory, then our *Townsmen* heere in *Oxford* in the eminent gifts of our choicest *Schollers*; Besides, that often happens in our great *Metropolitan* cities by the promiscuous concurse of diuerse dispositions; which is reported of the *beasts* once a yeare comming together to drink of *Nilus*, of diuerse sorts; that by vnnaturall commixture, they yearely beget new monsters: *Africa aliquid semper apportat noni.* 2 The ready meanes of *Advancement* to high and eminent dignities in *Metropolitan* cities, which are commonly the ordinary seats of Princes, sets many a braine a worke although *In vita Minerva*, to shew it selfe in publique: wherein he hath the advantage of *estimation* sooner then *sufficiency*: whereas many a towardly wit in places farre remote, neuer finds opportunity so propitious as to present him to popularity. I feare I shall be too tedious in this point, recalling to minde that I shall find few of my readers in this matter so affected as my selfe: Yet should I not haue spauue out this theame so long, but to stop their mouthes who being sooner taught to speake then vnderstand, take advantage of the rude language and plaine *attire* of our countrymen, admiring nothing more
then

then themselves or the magnificent splendour of their owne habitation: As though all the witt in the world were annexed to their owne *schools*, and no flowres of science could grow in another garden: But a rude *dialect* being more indebted to *Custom* then *Nature*, is a small argument of a *blockish* disposition: and a homely outside may shroud more wit then the Silke-wormes industrie. I haue sometimes heard a rude speech in a *Fraze* habite, expresse better sense then at other times a *scarlet Robe*: And a plaine Yeoman with a mattocke in his hand speake more to the purpose, then some Counsellours at the barie: And what other prorogatiue can such men appropriate to themselves aboue vs, but toyes and formalities, the Idols of *Gulls* and fooles, and the laughter of solide vnderstandings? But now after all this bickering with *Mr Bodin* to grow to a reconciliation, ere we part, we will part stakes, and in the way of kindenesse giue him this one distinction, which I hope for quietnesse sake, he will accept. The Naturall disposition of men and their gifts of vnderstanding and mentall faculties, arise either from their *naturall Temper*, or their *Discipline* and *education*: For the former I haue small reason to giue (as I haue said) the excellencie to the inhabitants of *plaine* and *low Countries*, rather then to the *mountaine* people: But in *discipline* and *education* I must confesse others commonly to be happier. 1. Because the *Fertility* and increase of the Earth inuiting men to such an Habitation, it must needs happen that such Countries must be more populous, and by consequence settle to themselves a better forme of *government*, then those which by reason of their barren soile are more neglected: 2. Because, most *Cities* and *Townes* where are found the cheifest meanes of *Institution* of youth, are founded in *plaine Countries* and *vallies*. This *Perfection* that such regions boast of, is owed rather to *Institution* then *Nature*: Hence appears the reason of the last clause of our Theoreme, to wit, why they should be lesse tractable to *government*: Because being (as it were) borne to too much *liberty*, they cannot so well inure themselves to *subjection*, as other who perhaps know no Condition but seruitude of

of the *mountainous* people of *Wales* and *Scotland*, I cannot speake so much as I intended: Both because I haue (I feare) tired already my readers patience, as also for that, being not so conversant in their Histories as mine owne, as an ill herald, I may chance to marshall all amisse. Who so list to reade the courage of our ancient *British* nation, he shall find enough aswell in the *Roman* Story, as our *English* *Chronicles*, to set them far enough aboue contempt, & place them an eye sore in the sight of enuy. But to leaue *Antiquities* and come to these times, we may easily amongst many other deserving men single out some, whose eminence so obvious to the eye of common observation, is able to dash *detracti*on out of countenance. Who hath not heard not many yeares since of Dr *Holland* the Kings Professour in our Vniuersity, and Sir *Roger Williams* a famous Coronell in the *French* and *Belgick* warres: the *Scholasticall Learning* of the one, and the *martiall* prowesse of the other, was too well knowne to require a *Panegyrick*. Neither is *Wales* at this day below her selfe, but that she can triumph in two of the most *Honourable* and *Generous Peeres* of this Land, (to whose acceptance I owe these my poore labours) and the greatest *Administratour* of Iustice in our Courts: the two former, borne aswell to hereditary vertue as greatnesse: the later advanced no higher then his owne ability, whom the world knowes beyond my expression.

Scarce had I shut vp this tedious discourse, spent for the most part in defence of my native Country, but surprized with a deepe melancholy, I entred into a serious consideration of what I had too rashly spoken: I called my meditations to a strict accompt, to examine what motiue should make me run so farre beyond my intended purpose, to meet the Ambition of my Country or mine owne affection. The remembrance of some grieuances; seconded by mine inbred Nature, neuer taught to fawne on misprision, beganne to check my officious penne, as guilty of too much weaknes or Adulation; when sudainly as in a vision there appeared vnto me my Mother *Oxford* shrouded in by *Ips* and all his *Muses*, who with a discontented countenance and harsh language, seemed to chide me in this manner:

Fond

Fond Sonne, who taught thy vnderferued praise,
 To crowne thy country with these thanklesse Baies?
 What owest thou vnto that barren Earth
 But harsh reproach, sad cares, and haplesse Birth?
 What Legacie bequeath'd that soile to thee,
 But fruitlesse Hopes, and helplesse Poverty?
 What thou hast spoken of thy Westernne strands,
 Will sooner plough vp mine, then cure thy wounds.
 Had thy neglected Muse without a Name,
 Spent halfe this industry to spinne my fame,
Ifs had graced thee with Muses more
 Then euer tript on thy *Devonian* shore.
 Which of these Worthies whom thou crown'st with
 Will ere thy wants relieue, or Fortunes raise? (praise
 All the proud wooers of the Sisters Nine,
 Like Pilgrims come to worship at my shrine:
 And vauntest thou on *Devon's* part their Names
 Who owe to me their worth, to her their shames?
 The prime and choice of all thy glorious flowres
 Cropt from my gardens and admired Bowres,
 Ought to returne the tribute of their praise
 Vnto my golden tongue and learned Layes:
 Nor had thy Westernne Confines euer found
 A Muse to sing of thy *Devonian* ground,
 Had not I touched her ambitious tongue
 First taught to chaunt amongst my learned throng.
 How oft hast thou drawne out thy precious time
 To tutour in my armes their youthly prime,
 Who like respectles and vtutour'd swaines,
 With losse and obloquie reward thy paines?
 Such are thy Darlings whom thou wak'st to ride
 In a triumphant carre by Honours side:
 As if proud *HONOUR* which can Kings command,
 As a poore seruant waited on thy hand.
 Thus thou vnwise giu'st immortality
 To those, whose base reproches follow thee.
 Had thine Ambition waited on my springs,

The breath of Princes, and the pow'r of Kings
 Had seconded thy Hopes, which now accuse
 To my disgrace and grieve thy haplesse Muse.
 Thy wants inforce thee still with me to stay,
 When each *Pedant* or makes or findes his way.
 To play and stake it at that lawlesse Game,
 Selling my Honours for to buy their shame:
 Vnhappie purchase ow'd to Charitie,
 Bought by connivence, sold to Perjurie;
 By griping Brokers, since the fatall time
 That faire *Astraea* left thy thanklesse Clime.
 Thus thy admired *Devon's* charitie
 Sets strangers in her lappe and shuts out Thee.
 Hast thou bin honour'd by my sacred Breath,
 'Mongst rude *Arcadians* thus to beg a Death?
 What greater glory can thy ashes haue,
 Then in my flowrie groues to dig thy graue?
 Although the least among my learned sonnes,
 Thy fortunes told thee that I lou'd thee once,
 And so doe still: although my haplesse Baies
 Taught thy despaire to spinne out carelesse daies,
 And to compose thy discontented Head
 To slumber sofilie on the Muses Bed.
 Be rul'd; by me my poore, yet loued sonne, (done:
 Trust not their smiles whose wrongs haue thee vn-
 Thy faire Hopes ground on thy place of birth,
 Will fly in *Atomes* or consume in Earth;
 Before within that Hemisphere of thine,
 Thy *Devon's* *Sunne* on thee shall euer shine.
 Then trust vnto my bounty, turne thy sight
 From thy darke Confinnes to my golden light.
 All thy endowments owed to my wombe,
 Returne them back, and there erect thy tombe.
 If no *Mecenas* crowne thee with his Rayes,
 Teach thy content to sleepe out quiet dayes.
 Let Contemplation with transpiercing eyes,
 Mount thee a pitch beyond the starry skies.

And

And there present thee that eternall glasse;
 Wherein the greenesse of this wondrous masse,
 Shrinks to an *Atom*; where my *Astrolabe*
 Shall shew thee starres beyond thy painted Globe:
 Where thou aloft as from a mountaine steepe,
 Shalt see the greatest men like Antes to creepe:
 Thy daies shall minister thee choicest Theames,
 Which night shall render in delicious dreames;
 And thy seuer Philosophy the whiles;
 In amorous kinde shall court thee with her smiles.
 Or if thy nature with constraint descends
 Below her owne delight, to practick endes;
 Rise with my morning *Phœbus*, sight the West,
 Till furrowed Age inuite thee to thy rest.
 And then perchance, thy Earth which seldome gaue,
 Thee Aire to breath, will lend thy Corps a graue.
 Soone the last trumpeter will be heard to sound,
 And of thy load Eate the *Drunonian* ground.
 Meane time if any gentle swaine come by,
 To view the marble where thy ashes ly,
 He may vpon that stone in fewer yeares,
 Engrauē an *Epitaph* with fretting teares,
 Then make mens frozen hearts with all his cries
 Drink in a drop from his distilling eyes:
 Yet will I promise thy neglected bones
 A firmer monument then speechles stones,
 And when I pine with age, and wits with rust,
 Seraphick Angells shall preserve thy dust,
 And all good men acknowledge shall with me
 Thou lou'st thy Country, when shee hateth thee.

This strange reproofe of an indulgent mother, I could not entertaine without passions. In somuch as without feare or wit, I adventured in this sort, to answer her, in her owne language.

Ad Matrem Academicam.

Unkindest mother, haue my former yeares
 Somuch deseru'd thy hate, or these my teares?

Thus to divorce me from my place of birth,
 To be a stranger to my native Earth?
 Wilt thou expose him on thy common stage,
 To strive and struggle in an Iron age;
 Whose low ambition never learned of thee
 The curious Artes of thriving policy?
 Thy golden tongue from which my younger daies
 Suckt the sweet musick of thy learned laies,
 Was better taught thy office then my fate,
 To make me thine, yet most vnfortunate.
 Why was I fostred in thy learned schooles,
 To study wit for the reward of fooles:
 That while I sat to heare the Muses sing,
 The *Winter* suddenly ore-took my *Spring*:
 Haue I so plaid the truant with my howres,
 Or with base riot stained thy sacred Bowres,
 Or as a Viper did I euer strue,
 To gnaw a passage through thy wombe to thriue:
 To pluck me thus from *Devon's* brest, to try
 What thou canst doe when as thy dugges are dry?
 When my short thread of life is almost spunne,
 Thou bidst me rise vp with thy morning sunne;
 And like a *Heliotrope* adore the *East*,
 When my care-hastened Age arriues at *West*.
 Could I encounter (as I once did hope,)
 The God of *learning* in the *Horoscope*,
 My *Phœbus* would auspicious lookes incline,
 On thy hard fate, and discontents to shine:
 Now lodged in a luckles *house*, rejects
 My former suites, and frownes with sad *aspects*.
 Had I bin borne when that æternall hand
 Wrapt the infant world in her first swadling band,
 Before *Philosophy* was taught the way,
 To rock the cradle in which Nature lay,
 My *Learning* had bin *Husbandry*: My *Birth*
 Had ow'd no toll but to the virgine *Earth*:
 Nor had I courted for these thirty yeares,

Thy

Thy seven proud minions with officious teares:
 To liue had bin my industrie: no tongue
 Had taxt thy *honours*, guilty of my *wrong*.
 Had I bin *shepherd* on our *Westerne* plaines;
 I might haue sung amongst those happie swaines;
 Some sheheardesse hearing my melody,
 Might haue bin charmed kind as charity,
 And taught me those sad minutes to retriue,
 Which I haue lost in studying how to thriue.
 Had I aduentur'd on the brinish some,
 And sworne my selfe a stranger to my home.
 Till time the *Haruest* reapt my *youth* did owe,
 And *Ages* winter had spent all her snow
 Vpon my haire; what worser could I haue,
 Then loose thy crownes to find a wished graue?
 The *Scythian* hewne from *Caucasus* would aske
 Before my slaughter, why 'a needles taske
 Of *Travaille* I should vndertake, to see
 Their Countries bounds and my sad mystery?
 But hearing my harsh bondage vnder thee,
 Would thine vnkindnesse hate and pittie me.
 To see thy Child far sever'd from thy wombe
 The *Canniball* would make himselfe my tombe;
 And till his *owne* were spent preserue my dust,
 I his deere vrne which thou hast sleightly lost.
 Canst thou neglected see his *Age* to freeze,
 Whose *youth* thou dandi'st on indulgent knees?
 The fowle aspersions on my *Devon* throwne,
 Thou mightst in right acknowledge for thine owne:
 On'y this difference: to men wanting worth
 They *sell* preferments, and thou *sends* them forth.
 Canst thou be brib'd to honour with a kisse
 Thy guilded folly which deserues the hisse?
 If thy forc'd wants and flattery conspire,
 To sell thy *Scarlet* to a worthles Squire,
 Or grace with *mini*uere some *proselite*
 Who nere knew artes, or reade the *Stagirite*;

Yet

Yet should thy hand be frugall to preferue
 That stock for want of which thy sonnes may starue.
 Haue I seru'd out three *prentiships*; yet find
 Thy trade inferiour to the humblest mind?
 And that outstript by vnrhists, which were sent
 Free with indentures ere their yeares were spent?
 Then cease ye sisters of the *Thesbian* Springs,
Thalia burne thy bookes and breake thy strings,
 And mother make thy selfe a *second* Tombe
 For all thy offspring, and so shut thy wombe.
 Accuse not my iust anger, but the *cause*
Nature may vrge, but fury scornes her lawes.
 I fawn'd too long on Iustice: Such that failes,
 Storme *Indignation* and blow vp my sailes;
 Ingenious choller arm'd with Scorpions stings
 Which whippst on Pefants, and commandst Kings;
 And giu'st each milky soule a penne, to write
 Though all the world be turned a *paradise*;
 Temper my braiaes, thy bitternesse infuse,
 Descend and dictate to my angry Muse.
 O pardon mother something checkes my spleene,
 And from thy face takes off my angry teene:
 Revolted *Nature* by the same degrees
 Goes and returnes; begges pardon on her knees:
 Thou art a *mirrour* by reflexion taught
 To faine defects, yet guilty art of naught.
 Thy *stewards* which by thy indulgence thrive
 Were they as iust, as thou art free to giue,
 We all might share a portion of that store,
 Which now thy sonnes deserue, thy *slaves* deuoure.
 Thy *will* is seldome measur'd by the *Law*,
 But *power*, whose greatnesse thy Edicts can awe,
 Slights thy decrees: O would *Imperiall Ioue*
 But once descend from his high Court aboue,
 To see thy innocent and maiden hands,
 By thine owne seruants basely shut in bands:
 These *Caterpillars* by his three-forkt *Rayes*,

Would

Would soone be scorch'd from off thy sacred Bayes;
 And thou restor'd vnto that pristine hue,
 Which ancient times admir'd ours neuer knew.

All this time as in a fit of phrensy I haue spoken I scarce know what my selfe: I feare me too much, to, or of, my *Country* and *Vniuersity*, and too little for the present purpose. Now as one suddainly awaked out of sleep, no otherwise then in a dreame I remember the *occasion*: We haue all a *semel Insanimus*, and as a learned man of this Vniuersity seemes to maintaine, no man hath euer had the happines to be exempted from this imputation: And therefore I hope my Reader will pardon me this once, if in such a generall concurse and conspiracy of mad men, I sometimes shew my selfe mad for company.

3 Windy Regions produce men of wild and instable dispositions; but quiet regions more constant and curteous.

The cause of this disparity is apparant; because a quiet mind, and apt for contemplation, cannot be in such a man, as is perpetually tossed to and fro. For no man can well contemplate, except he haue his mind purged and free from motion of the body; and it is noted by *Physognomers* that wiser men are slower in the motion of their body and mind, whereas mad and franticke men are alwaies buied in body & mind. Hence a reason may be giuen why *Mariners* and *seamen* being continually tossed with the wind, are observed to be more *barbarous*, *inhumane*, and *inconstant*. Another reason of this inconstancie and change, may be drawne from the change of the *Aire*, caused by diuersitie of winds; For wind being an exhalation affecting the aire and deriued from the Earth, must needs be diuerse in regard of the diuerse regions, from whence it bloweth. What cause soeuer be imagined, it is most certaine that people in windy regions haue bin more warlike, though perhaps lesse humane: As in *Thracia*, *France*, *Circassia*, *Lybia*, *Portugall*, *Persia*, *Noruegia*, and *Polonia*: But in places in the same tract where the wind hath a lesse

domination we shall find them more tractable, but lesse valiant, as *Afryia*, *Asia minor*, *Italy* for the most part, and *Egypt*. In like manner the people of *Gallia Narbonensis*, *Aquitany*, and *Provence* in *France*, are observed to be the most warlike, although situate in a more Southerly tract: Being daily infested, partly by the *Vulturius*, partly by the *Corus*, which in these parts hath great power.

4 *Sea borderers are generally more witty and adorned with more knowledge, then Inlanders, though subiect to greater vices.*

That *Artes*, *Civiliz*, and many *inventions* are owed to the *sea*, as the mother of increase, seemes a matter out of question: For sith all nations haue not found out all *arts* and *inventions*, it must follow necessarily, that they haue bin propagated by *traffick*, and commerce with forraigne nations: Whence it comes to passe many times that *sea-borderers* by conference with *out-landish* people, haue gotten that knowledge and experience of things, for which others haue with great cost and danger adventured on long and tedious trauailes: Which I take to be the reason why *Themistocles* would haue a Citie depending on the sea, and not as *Calius Rhodiginus* imagines, that he might transferre the power from the nobility, to the *ship-masters*. Thus we find *sciences* and *learning* to haue bin deriued from the *Chaldeans* to the *Egyptians*, from the *Egyptians* to the *Phanicians*, from them to the *Gracians* and *Romans*: And in our daies euery man can speake how much the industrie of the *Venetians*, *Spaniards*, *Hollanders*, *English*, and *Portugalls* haue effected in both *Indies*, in trafficking with them, deriuing together with their merchandice, much of their owne knowledge and religion. But as the *Ilanders* & *sea-bordering* people haue excelled the *Inland* nations in skill and knowledge, so also in vices: Which stands with reason, whether we ascribe it to their naturall wit or condition of life, or education. For the greatest wits are commonly matched with the greatest vices, as depending on such a temper of the braine whose smallest change may beget madnesse: according.

ding to that proverbe, *Nullum magnum ingenium sine mixtura infans*. Also Artes and Sciences turned to the worst vse, become more dangerous, then naked *simplicity*; for there is nothing to be feared more then *armed furie*. This might be the cause why *Plato* in his booke *de Republica* waines men to avoide the sea, as the mother of wickednesse. Which is seconded by *Strabo*, who derives the of-spring of *Robberie, pillage, and murder*, from the sea: By which argument, the old *Athenians* were enduced to draw the Inhabitants asinuch as they could from sea-trafficke to husbandry and tillage of the Earth: Whence came at first (as some imagine) that fable of *Neptune* striving with *Minerva* for victorie, against whom she prevailed, by shewing the iudges a *mandrakes* apple as an especieall rarity of the land.

CHAP. XVI.

Of the dispositions of Inhabitants according to their Originall and Education.

IN the third place there may be a diversitie of Inhabitants in disposition, either in respect of their Of-spring, or their Education. In the former we are to consider the dispositions of nations so farre forth, as it depends from their first stocke and originall.

By the first stocke and originall of nations, we vnderstand not heere either the first of spring from the loyns of *Adam*, or the second from *Noah*; because these two are common to

all nations of the world, and therefore cannot vary the severall dispositions of people: But the more *mediate* or speciall stock whence they sprang, which is found to have no small power in the nature and temper of posteritie. In this of Spring two things are chiefly remarkeable; first, how people suffer an alteration in respect of their severall *Transplantations*: Secondly, in the *mixture* of colonies, both which we will shew in these Theoremes.

I Colonies transplanted from one region into another, farre remote, retaine a long time their first disposition, though by litle and litle they decline and suffer alteration.

L All *mutation* requires a certaine distance of time: Such no motion according to *Aristotle* is in an instant, neither is it a small time can alter the naturall *complexion* of men: For as much as the children for the most part deriue their nature from their parents, and euery mans constitution is commonly radically grounded, and not easily subject to externall change: Thus wee see the Children of *Blackmores* being transplanted into *Europe* for diuerse descents to continue *black*: Yet so as they by litle and litle declining from their former hue, will in time become *white*; as the rest of the *Europaean* Inhabitants: For otherwise it must needs follow, that *Seythia* should at this day breed many *Blackmores*, and *Aethiopia* many *white*; because no question can be made, but that all nations almost of the world since the beginning haue suffered *mixture*. We read that the *Gothes*, being a warlike people of the *North*, long after their first invasion of *Spaine*, *France*, *Italy*, and other Territories of *Europe*, retained their owne *disposition* and *nature*, altogether disagreeing with the nations, amongst whom they liued: governing (as is the manner of *Northerne* Potentates) rather by *Strength* then *Policy*, better able to *winne* then *establishe* an Empire. But in proceesse of time it came to passe, that putting off their harsh temper they grew into one nation with the native Inhabitants, as in *France* and

and *Italy*, or at least as in *Spain*, establishing a government o-
 their owne, by litle and litle declined from their rudenesse to
 civility, turning their *armes* to *Artes*, their *strength* to *strata-*
gemmes, having of late yeares by witty pollicy established a
 greater empire, then euer their Ancestours could atcheiue by
 multitudes of men, and strength of armes. And it is worth
 observation, that as these haue suffred a change of *Lawes*, *cus-*
tomes, *government*, which they owe more to the nature of the
Climate then to *Education*; so in their very language. For
 the language of the *Goths* heretofore, differed litle from the
 language of the ancient *Germans*, which (as most *Northerne*
 languages) was very rough, consisting of many hard and
 harsh aspirations, with vnpleasane collision of many *con-*
sonants together: But at this day is changed into a very elegant
 tongue pleasant to the eare, consisting of many *vowels*, and the
 softest aspirations. Finally such haue bin the alterations of
 this people, that being heretofore far *North*, & branded with
 all the markes of *Northerne* rudenesse, they are now esteemed
 in the Catalogue of *Southerne Inhabitants*: Not in regard, as
 much of *place*, as *nature*. The like may we obserue of the
Turkes and *Tartars*, who spreading their empire from the
North towards the *South*, a long time retained their rude
 barbarous *nature*, which they haue not at this day altogether
 cast off; yet so much hath time and place gained vpon their tem-
 per, that they are much mollified and farre more tractable to
humanity, addicting themselves euery day more and more to
 the study of *artes* and *civility*: inso much that (as one obserues)
 had they not preserved their strict *discipline* in training vp
 their youth to *armes*, they had long since lost much of their
 large empire, and haue yeelded to the *Polonian* and *Musco-*
vite. This change may we find not onely in *man-kind*, but al-
 so in *beasts* and *plantes*, which being transported into other
 regions, though a long time retaining their natie perfection,
 will notwithstanding in time by litle and litle degenerate: As
 I haue heard by relation of some of our *Virginian* colony in
America: who find a great alteration in our *Corne* and *Cat-*
tle, translated thither. This might also be obserued in the

Danes, Saxons, and Angles, comming into *Britanny*, who partly by the *Clim* & partly by mixture with them, by little and little deposed their disposition, and became more *civill*. The like may be spoken of the *Saxon* colonies sent by *Charles* the great into *Belgia*, who since that time becoming more *civill* have proued lesse warlike, loosing asmuch by the one, as they obtained by the other. This point I will no further persecute, because I hold it sufficiently demonstrated out of that I have spoken of the variety of naturall dispositions according to the heavenly situation, and the soile. For sith a Nations came at first from one originall, we must needs ascribe this mutation to the places which they inhabite.

2 The mixture of Colonies begets in the same nation a greater diffartie and varietie of the Inhabitants amongst themselves.

This proposition is by naturall consequence deduced from the former: "Because all Colonies transplanted retaining some-what of their former nature, the Mixture must produce varietie. First, because the number of people of any region by this is supposed to consist of more kinds of dispositions: 2^{ly}, because the promiscuous mixture of these kinds being vnæqually tempered, must according to their severall combinations produce people, as vnlike one to the other, as to the former. Hence a reason may be giuen, why the Inhabitants of the extreame regions, either North or South are found to be amongst themselves aswell in-temper, as in externall face & habite more like one to the other: whereas the middle partake of more variety. For the *Cimbrians*, *Danes*, and other *Scythians*, are for the most part of a whitish hue, with flaxen, and yellow haire; on the other side the *Aethiopians* for the most part are black-haired and curled. The *French*, *Germans*, and the *English*, admit of all varietie, hauing some white-haired, some black, some yellow, some rawnny, some smooth and some curled-pates. This diversitie the *Stoicks* would ascribe to the phantase, or image conceiued in the mind of men. Whence they would giue a cause, why beasts commonly bring

bring forth yong, more like one the other then men: because (say they) wanting a reasonable soule they are not stirred vp as men with sundry cogitations, but onely with sence. So the *Scythian* and *Northerne* man being by nature more simple, & affecting those pleasures which are agreeable to nature, and lesse distracted by variety of thoughts, is found to beget children more like their parents then those of the *middle climate*. This cause we should admit probable enough, but for a reason urged by *Bodin* and others, that in *Aethiopia*, where the people of all other is more *Acute*, and more violent in lust, they are most like one to the other. For euen all are found to be *small* of stature, *curle-pated*, *black-skinned*, *flat-nosed*, *smooth-skinned*, *great-lip'd*, *white-toothed*, *black-eyed*: Wherefore this infinite diversity in the middle region, we cannot well ascribe to any other reason, then the manifold intermixture and combination of both the extreames. Whence it comes to passe, that by how much more we wander from the *middle region*, somuch the more like shall we find the people amongst themselves: Insomuch as *Tacitus* spake of the *Germans*, that amongst themselves they were very like in respect of other nations. This mixture in the *middle region* out of the *extreames*, may easily be shewed out of diuerse Colonies, which from the *extreames*, haue binne translated into the *middle region*, as the better place of habitation. For hither came the great and extraordinary armies of the *Scythians*, *Goths*, *Turkes*, and *Tartars*; None besides the *Vandalls* passed into *Affricke*, from whence they were in short time expelled. The *Arabians* and *Puniceans* called by the ancient *Saracens*, leading their Colonies into *Europe* & *Asia*, settled themselves in the *middle region*; None came into *Scythia*: for when they had invaded *Spaine*, *Italy*, and *France*, they were in *France* altogether broken, and cut off: After which, *Spaine* and *Italy* found a meanes to free themselves from their bondage. Likewise the Colonies of the *Celts* and *Romans*, endeouored alwaies to settle themselves in the *middle Region*, and neuer ventured as far as *Scythia* Northward, or Southward as farre as *Aethiopia*: Whence the *middle* charred

with

with intermixture of both *extreames* begat a great diversitie. For we find by experience, that out of the mixture of diverse *kinds*, diverse *Formes* and *Natures* are ingendred: As of the *Mule*, *Leopard*, *Crocota*, *Lycisca*, and *Camelopardus*; which being *mixt* Creatures are vnlike their Sires: So may we iudge of the various mixture of diuerse kinds of men. A *Mas-tisse* or *Lycisca*, little differs from a *Wolfe*, because he was conceiued of a *Wolfe* and a *Dogge*; So that a *Wolfe* is, (as *Varro* noteth) nothing els then a *wilde Dogge*. But on the other side, a *Mule* from an *Asse* and a *Horse*, As a *Camelopardus* from a *Panther* and a *Camell*, differ very much; so that if people very neere in *Nature* be linckt together, they produce an off-spring very like themselves: But if two very vnlike in nature, as an *Ethiopian* and a *Scythian* should match together, they must needs bring forth a birth very vnlike to themselves: like a *Personated man* brought vpon the stage by *Ptolomæus Philadelphus*, who (as *Athenæus* writes) was of two colours, on one side *white*, on the other *black*.

2 The second point whereby the disposition of people is varied, is *Education*. Education is the exercise of many people in religious, or morall discipline.

Amongst all externall causes of the change of dispositions, there is none greater then *Education*. For as a good nature is oftentimes corrupted with evill conuersation, so an ill disposition with good institution hath in some sort bin corrected. The cheife objects of discipline are *Religion* and *Morality*: Whereof we giue the cheifest prerogative to *religion*, as that which more immediatly bindeth the *consciences* of men, even against nature. In the second place *Civility*; whose end is worldly happines. How farre each of these pravaile, shall be shewed in these Theoremes.

1 Education hath great force in the alteration of naturall dispositions: yet so as by accident remitted

remitted, they soone returne to their former temper.

The force of *institution* hath bin so great, that by some it hath bin thought to equall, if not surmount *Nature*; whence they haue tearmed it a *second nature*: For as we see all sortes of *Plantes* and *Hearbs* by good husbandrie, to grow better, but left to themselves to grow wilde and barren; So shall we find it, if not much more, in *mankind*; which though neuer so *Savage & barbarous*, haue by discipline bin corrected and reformed, and though neuer so *Polite* and civill neglecting discipline, haue degenerated, and growne barbarous. For if the externall lineaments of the *body* may be by art (as it were) wrought into another mould, much more may we ascribe this to the habits and operations of the *mind*, being of a more agill nature, and apter to receiue impression. The ancients amongst the *French* (as *Bodin* testifies) deemed a long visage the most handsome: Whence the Midwiues endeavoured to frame most faces to this fashion, as may be seene in most ancient statues & images. In *India* (as we also reade) a *great nose* and a *broad face* was most admired: which caused their midwiues to effect it as nere as they could in their tender infants. In like manner it hath bin the endeavour and ambition of most teachers, and informers of youth, to frame the *wits* of their nouices to such disciplines and perfections, as in the same country found most honor & best acceptance. Hence it came to passe that *custome* prevailing beyond *nature*, many nations situate in a ruder climate, wanting that benefit of the *Heauens* which others plentifully enioye, haue surpassed them in *Artes*, *Sciences*, and many other *Endowments* of the minde. In so triuiall a matter we will not roue farre for example. It is recorded by the ancients, as well of the *Germans*, as of our owne nation, that they liued almost in the condition of *wilde beasts* in Woods & Desarts, feeding like swine on *hearbs* and *rootes*, without law or discipline: Insomuch as their *Bardes* or leatned men (as they deem'd them) wanting the vse of *letters*, challenged their cheifst perfection in the composure

of certaine *rimes* of triviall subjects to please the people. Their houses were *caves*, their *pallaces* *brakes* and *thickets*, their *tables* *rocks* (as one saith of them) *Antrallares*, *dumeta thiros*, *cannatula ruper*. They were (as *Iustine* speaks of the infancy of the world) rather carefull to keepe their owne, then ambitious to conquer others; and more studious to preserve life then seeke honour. Their onely law was nature, or some few customes preserved by tradition, not writing. Little differing from the present *Americans*, not yet reduced to civility. But *time* and *discipline* prevailing against *barbarisme*, they are (God be praised) reduced to such a height of civility, that they may (as it were) reade other mens *wanes* in their owne *perfections*, and measure other mens *losse* by their owne *gaines*. In so much as they seeme to have robbed the *Asiatickes* of *humanitie*, the *Romans* of *militarie Discipline*, the *Hebrewes* of *Religion*, the *Gracians* of *Philosophie*, the *Egyptians* of *Geometrie*, the *Phonicians* of *Arithmetick*, the *Chaldeans* of *Astrologie*, and almost all the world of curious *Workmanship*. This their excellency hath bin so fortunate, as to set them in the envy of other nations, who notwithstanding have bin faine to borrow of their store. The *Italians* are censured by *Machnavell* the *Florentine* for sending for *Germans* to measure their land, challenging to themselves the prerogative of *wit* above other nations. Likewise *Pope Leo* dispatched his *Embassador* into *Germany* for *Mathematicians*, to rectifie the *calender*, as sometimes *Cesar* into *Egypt*. This force of discipline how great soever being for a time neglected, nature is notwithstanding found to returne to her owne corruption. A prime example of it we have in the *Romans* and *Italians*, heerebefore for *Artes* and *Military discipline* carrying away the *palme* from the whole world: But now degenerated so much, as it may seeme the image of *base-nesse*; submitting their neckes to the pride of an insulting *Prelate*, farre more abject then the *losse* of their *libertie* vnder *Cesar*, or the *Goths* usurpation of *Alaricus*. The like effect of this neglect of discipline may we find in the *Hebrewes*, *Chaldeans*, *Phonicians*, *Egyptians*, *Gracians*, and *Indians*,
who

who were sometimes admired for *learning* and *Eloquence*, and set in the highest top of perfection. Wherefore *Aristotle* had good reason in his first booke *de Caelo* to affirme, that *Artes* and *Sciences* with all nations had bin subject to *ebbes & flowes*, sometimes *flourishing* in great perfection, and sometimes *languishing* and contemned. And to this and no other cause, can we ascribe the present *Ignorance* and *Barbarisme* of the *Americans*: Their descent being from *Noah*, and his posterity, they could not at first but haue some forme of *discipline*, which afterwards being by long proesse of time or incertainty of *tradition* neglected & obliterated, they fell back into such waies as their owne depraued nature dictated or the devill maliciously suggested.

2 By Discipline nations become more wise & politick in the preservations of states, yet lesse stout & couragious.

As Discipline hath bin the cheife cause of the establishment of all states, so bath it on the other side bin occasion to *soften* and weaken the courage of many nations: For it hath binne many times seene, that such people who haue bin commended for *wit*, haue yeilded to such who are of a ruder disposition: as at this day the *Greekes* and *Macedons* to the *Turkes*, the ancient *Gauls* to the *French*, the *Egyptians* to the *Persians*, the *Chaldeans* to the *Saracens*, Hence some giue a reason why the *French* did invade and runne over *Italy* without controule vnder *Charles* the 5; because the *Italian* Princes at that time were giuen to *study* and *learning*; and it is observed that the ancient *courage* of the *Turke* is much abated, since the time that they grew more civill and more strictly imbraced discipline. And this some thinke to haue giuen occasion to *Alexander* the great, to conquer the *Persian Monarchie*, the *Persians* having bin before reduced to civility, and lost their hardnesse. And we daily see by experience, that no men are more desperate and aduenturous, then those which are *rude & barbarous*, wanting all good *manners & education*. None more *fearfull* and many times more *cowardlike* then

such as are most *wise* and *politick*: an example of the former we haue in *Aiax*, of the other in *Ulysses*, wherevpon the wisest *leaders* and commanders haue not bin esteemed the most valiant. A certaine English gentleman writing military observations affirmes the *French nobility* to be more valourous & couragious then the *English*. Because of the loosenesse of their *discipline* and the *strictnes* of ours. But I will neither grant him the one or the other, neither can I averre their *courage* to be greater, or our *discipline* stricter. If their valour be more, it must needs follow their *wit* is lesse out of this ground. But howfocuer it be, I am sure that *Cesar* and *Tacitus* giue the cause of the great stature and courage of the *Germans* to be their *loosenesse* and *liberty*, which howbeit it be not the sole cause, it must needs be a great helpe. For we plainly finde by experience, that those countries which be most *mountanous* where is lesse discipline, are found to produce men for the most part, most *warlike*: Such as the *Switzers* in *Germany* and *Biscaynes* and *Arragonians* in *Spain*. Whence (as some obserue) such countries as are partly *Mountanous*, partly *plaine* are seldome at quiet, the one part willingly submitting themselves to government, the other affecting warre and rebellion. Which hath bin the cause of the troubles of *Naples*, and in *England* before *Henry the eight's* time, betwixt the *Welsh* and *English*. Why discipline should in this sort mollifie and weaken the courage of men, many causes may be giuen. The first and greatest is *Religion*, then the which, there is no greater curbe to the *courage*, not meerey of it selfe, but by accident; Because *Death* being the greatest hazard of a *soldier*, religion giues a more eident apprehension & sense of the *immortality* of the soule of man, and sets before the eye of his vnderstanding, as it were the images of *Hell-paines* and *Celestiall ioyes*, weighing in an æquall scale the danger of the one, and the lesse of the other. Whereas ignorant people wanting all sense of *religion* lightly esteeme of either, holding a temporall death the greatest danger. Whence grew the vsuall Proverbe amongst profane *Ruffians*; that *conscience makes cowards*. But this (as I said) is meere-

ly accidentall: For asmuch as nothing spurres on a true resolution more then a *good conscience*, and a true touch of religion; witnesse the holy *Martyrs* of the Church of all ages, whose valour and constancie hath outgone all heathen presidents. But becaus: soldiers for the most part, being a most dissolute kinde of people, hauing either a *false religion* which can suggest no setled resolution, or an ill conscience grounded vpon no assurance, *Religion* must needs beget in them a more fearefull disposition. Another cause may be the severity of discipline, which especially in the training vp of youth, is mixed with a kind of slavery: without which our yonger yeares are very vntractable to tast the bitter roots of *knowledge*. This feare (as it were) stamped in our affections cannot but leaue behind it a continuall impression, which cannot suddenly be razed out. Such as we find in vs of our *masters & teachers*, whose freindship we rather imbrace, then familiarity. A third reason, why discipline would weaken and mollifie a nation, may be the delight which men reape in *Contem-plate* studies, and *morall* or *politick* duties, whence followes a neglect of the other. For people of *knowledge* must needs finde a greater felicity in giftes of the mind, which is usually seconded with a contempt of externall and military affaires. The last cause may be the want of vse and practise of military affaires in most common weakhs; for many states well established continue a long time without warres, neither molesting their neighbours, nor dissenting amongst themselves; except very seldome, and that by a small army, without troubling the whole state: whence the generall practise being lesse knowne, becomes more fearefull. Notwithstanding, all this it were brutish to imagine *discipline* any way *unnecessary* or *hurtfull*, either to a *captaine* or *statesman*. For asmuch as it more strengthens the *wit* then abates the *courage* of a nation. Neither is it properly said to breake and weaken, but rather to temper and regulate our spirits. For it is not *valour*, but rather *rashnes* or *fiercenes*, which is not managed with *policy* and discretion. And although it hath sometimes bin attended with notable exploits, as that of *Alexander*

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the great, of the *Goths*, the *ancient Gaules* and many other. Yet shall we obserue such conquests, to be of small continuance: For what they archeived by *strength*, they lost for want of *policy*. So that it is well said by one: that *moderation* is the mother of *continuance*, to *States* and *Kingdomes*. Thus haue we runne ouer (by *God's* assistance) the cheife *causes* of diuersitie of *dispositions* of Nations: Wherein if any man will enforme himselfe (as he should) he must compare one circumstance with another, and make his iudgement not from a man but a nation; and not censure any nation out of one observation: For *practise* in *Art* cannot alwaies come home to *speculation*. So *experience* in this kinde will oftentimes crosse the most generall *rules* we can imagine. Tis enough to iudge as we find, and walke where the way is open; If any man will desire more *curiositie*, he may spend more labour to lesse purpose. Let euery man by beholding the *nationall vices* of other men, praise *Almighty God* for his owne *happines*; and by seeing their *vertues*, learne to correct his owne *vices*. So should our *travaile* in this *Terrestriall Globe* be our direct way to *Heaven*: And that eternall guide should conduct vs which can neuer erre: To whom be ascribed all *Glory*, *Praise*, and *Power*, for euermore.

Deo triuni Laus in eternum.

FINIS.

